ELECTRICAL REVIEW

24th JULY, 1953

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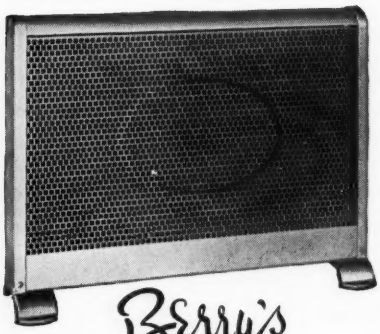

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ELECTRICAL REVIEW

24th JULY, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. 153 • NO. 4

Domestic Revival

SOME of the Electricity Boards are perturbed at the poor return from the expensive extensions they have made in rural areas and they are constantly endeavouring to persuade farmers and their wives to make better use of the service. But it is not only the country dwellers who are failing to take full advantage of the benefits of electricity. This is attributable largely to the fact that for a long time the Electricity Boards have had to look on almost helplessly while the use of electricity in the home was generally discouraged, ostensibly because of plant shortage, but often to boost the sales of solid-fuel appliances. Release from this disability should enable them to obtain a better return from capital already spent in the towns as well as from the capital they are to be allowed to spend in rural areas.

By this time the whole of the British public must be aware that things are moving in the electrical world, for the Electrical Development Association's effective advertisements are now appearing in nationally popular periodicals regularly. These should do much to clear the public mind of the inhibitions implanted by subtle (and not-so-subtle) anti-electric propaganda over a long period. But by themselves these advertisements will not restore public confidence in the electricity supply industry; they must be followed up by closer contacts between the public and representatives of the Boards. The latter must equip themselves for the purpose with a full knowledge of the apparatus available and methods of selling it. In this they can rely upon the assistance of E.D.A. and also of the manufacturers. To the same end the *Electrical Review* is publishing a series of articles on various aspects of domestic electrification, the first of which, by Mr. N. F. Marsh entitled " Domestic Development," appears in this issue.

Sales staffs may find themselves out of practice so far as real selling is concerned, and they will certainly find their " prospects " harder to convince after the long period of discouragement.

Moreover, the restoration of freedom to the electricity supply industry will be accompanied by a similar measure of relief to the gas industry, which has also been fettered, and intense competition must be anticipated. Nevertheless we feel that the electricity advocates have a good case and must succeed if it is properly presented. The results will be beneficial to the public which will secure aids to better living, to the electricity supply authorities whose load curve valleys will be filled in, and to the manufacturers of appliances who must have a substantial home market before they can successfully sell their goods overseas.

THE ST. LAWRENCE SCHEME

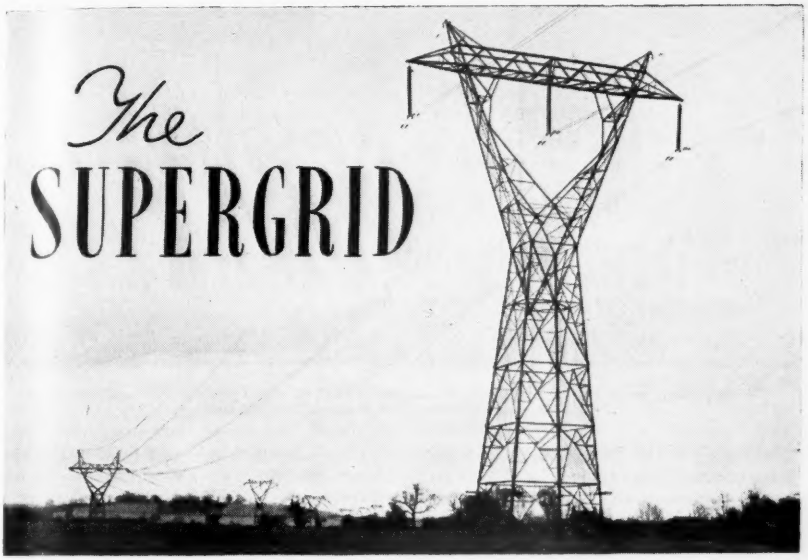
The Canadian half share of the 1,500 MW of hydro-electric generating plant to be made available at the St. Lawrence rapids will add substantially to the Dominion's power resources. Subject to the result of litigation concerning participation by the United States Government, preliminary site work is expected to be started before next winter. The cost of the hydro-electric portion of the total project for linking the Great Lakes with the sea has been estimated at up to $600 million. Co-operation between British consultants and manufacturing and contracting firms in Canada has placed them in a favourable position to take an important part in this and other major hydro-electric developments there.

INTERCONNECTION AND TRANSMISSION

We well remember the controversy at about the time of the passing of the 1926 Electricity Supply Act over the principle of establishing the 132 kV grid in the form of self-contained area networks to operate independently, but with interconnectors between the areas for stand-by use only. We remember too the general surprise at the announcement by the former Central Electricity Board soon after the end of the last war that the grid had been operating on a national basis for some time because the changed generating and loading conditions in the grid control areas had resulted in the necessity for a measure of major transmission via the tie lines. It was therefore particularly interesting to be reminded last week on the occasion of the inauguration of the first section of the new 275 kV supergrid, described elsewhere in this issue, that while some sections of the supergrid will also serve for transmitting substantial blocks of energy, particularly from new generating plant in the East Midlands and Yorkshire areas to those areas remote from the coal fields, the primary function of the supergrid is of interconnection between the grid areas.

STILL HIGHER VOLTAGE?

The transmission commercially of electricity in Sweden at 380 kV, in the United States at 330 kV, and the talk of an American 500 kV supergrid all prompt the question: what are the prospects of an even higher voltage than that of the new 275 kV supergrid in Great Britain? Useful comments by the British Electricity Authority on this matter are that the 275 kV supergrid embraces about 1,200 route miles of lines and 22 switching and transforming centres, giving an average route length of only 52 miles between stations. There is not, therefore, the same economic case for adopting the very highest voltages on the transmission lines as applies, for instance, to the 600 mile line in Sweden. Further, the climatic and atmospheric conditions in Great Britain make reliable operation of electrical equipment difficult at very high voltages. At times the 132 kV grid is not immune from trouble due to severe fog and atmospheric pollution, and the performance of the 275 kV supergrid under similar conditions has yet to be proved by a period of practical experience.

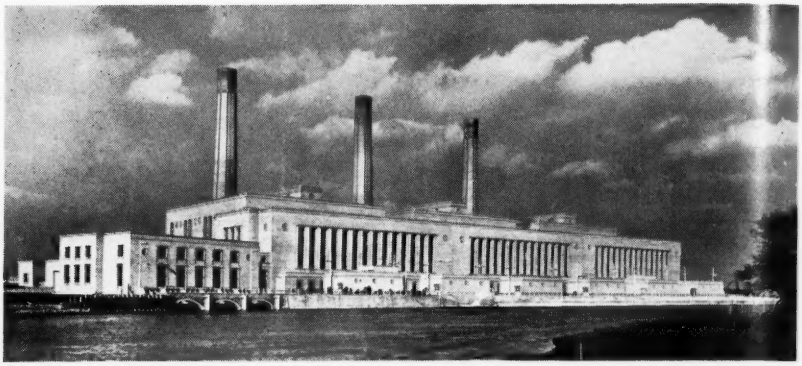


Inauguration of the First Section

ON 15th July the first section to be completed of the 275 kV supergrid was officially inaugurated by Sir John Hacking, M.I.E.E., deputy chairman (operations), British Electricity Authority, and we think the occasion is opportune for the publication of a description of the supergrid in general and of the first section —from Staythorpe (Newark) to West Melton (Sheffield)—in particular.

It is generally well known in the electricity supply world that the main object of the 132 kV grid, as planned in 1926, was to interconnect power stations within certain defined areas, and that the advantages resulting from these inter-station connections have been a substantial decrease in the proportion of spare generating plant and a greater concentration of generation in the more economical power stations. But it may not be so widely appreciated that the interconnecting lines between the areas are not of sufficient capacity to permit full-scale transmission of power on a national basis, their original purpose being limited to stand-by use; further, that because of a change in the " balance " of generation in the areas which has occurred during the past 20 years or so the interlinking between the areas has gradually become a main transmission system. Indeed, during the war it became apparent that the scale on which it would be necessary to transfer energy between the areas would soon exceed the limited capacity of the interconnecting tie lines.

Examination of the problem was therefore inititated by the former Central Electricity Board and continued by a committee set up by the British Electricity Authority. The report of the committee, which was adopted in July, 1950, recommended that a substantial increase in the capacity of interconnectors between different points of the national grid was necessary on economic grounds, and that this " reinforcement " should be provided by a small number of lines superimposed on the existing grid and forming in normal circumstances the sole connection between the areas. A higher transmission voltage (275 to 300 kV) was also recommended for



The Staythorpe power station has a planned capacity of 360 MW and it has a direct association with the 275 kV Staythorpe-West Melton supergrid line

this supergrid in that it would provide extra transmission capacity to allow for the siting of new power stations in regions where fuel costs were lowest. It was also suggested that the towers on some sections should be designed for operation at a higher voltage in readiness for a possible need for higher voltage transmission at a later date.

At that time (July, 1950) work was already in progress on the erection of a trial section of line between Staythorpe and West Melton which was intended for operation at 264 kV, although later this was changed to 275 kV. Further, a full-scale experimental line was erected near the B.E.A. laboratories at Leatherhead, Surrey, for obtaining further technical data relating to the operation of overhead lines at voltages up to 500 kV.

This first section of the supergrid is the only supergrid line of single-circuit construction. The three twin conductors of 0·175 sq in copper equivalent section are arranged in horizontal formation at 32ft 6in spacing, and two earth wires are used. For its initial operation the line will be connected to the 132 kV grid through 120 MVA auto-transformers at Staythorpe and West Melton. It is anticipated that by the end of 1955 Staythorpe will have its full planned capacity of 360 MW, and then the 275 kV substation will have direct association with the power station, as is at present the case with the adjacent 132 kV substation.

At the other end of the 275 kV line the arrangement is rather different, in that the West Melton 132 kV substation is not directly associated with any one main power station, but is connected by overhead lines to several power stations. The supergrid substation at West Melton is also scheduled for full commissioning in 1955. To sum up the position regarding the Staythorpe–West Melton 275 kV line then, it may be said that it links a large power station on the East Midlands coalfields with a "marshalling point" for power stations on the Yorkshire coalfield, and that it constitutes an interconnector rather than a bulk transmission channel. The 132/275 kV auto-transformer at Staythorpe is of B.T.H. manufacture and that at West Melton is of English Electric production. Switching for the line is effected at 132 kV at the Staythorpe end in the adjacent normal grid substation, while at West Melton arrangements have been made for switching at 275 kV and are actually being carried out at present at the higher voltage by means of an English Electric 275 kV. air-blast circuit breaker which has been installed on an experimental basis by permission of the B.E.A.

This circuit breaker has a normal current rating of 800 A and a rupturing capacity of 7,500 MVA. The breaker consists of three identical single-pole units coupled together electrically and pneumatically, each s.p. unit comprising six identical interruptors connected electrically in series and mounted in two vertical columns, each

carried on a supporting structure of porcelain insulators with a triangular base. The interruptors are of the axial blast pattern shunted by porcelain-clad non-linear resistances (or surge divertors) and are identical to the interruptors used on the English Electric 132 kV 2,500 MVA and 3,500 MVA air-blast breakers in operation elsewhere on the Authority's system. The two columns are connected electrically by double make-switch blades operated from air engines in the mechanism housing. An air jet is provided through the blades for ice breaking purposes. The local air receivers are mounted at the base of the support columns adjacent to the weather-proof cabinets which house the blast valves, control valves, anti-hunting relay and mechanically driven auxiliary switches. Compressed air is carried from the base to the interruptors and make-switch operating air engines by way of the support insulators.

The blast valve, control valves, etc., are in the cabinet at the base of each phase, and the contacts can be removed through the inspection doors. The air is compressed and stored at 600 lb/sq in in outdoor mounted receivers fed from standard compressor units, and is fed via an automatic reducing valve at a pressure of 300 lb/sq in through duplicate bus air pipes to the circuit breaker control cabinets, where stop valves are provided, and thence to the breaker receivers. The current transformers are separately mounted in oil filled porcelain-clad enclosures; the design incorporates a hairpin primary winding with graded insulation designed to meet the test specification for the circuit breaker.

In the initial stages the line is controlled at each end by isolators manufactured by Ferguson Pailin, Ltd., the type BE.A.300 isolator being employed. This is of common design developed by the English Electric Co., Ltd., the General Electric Co., Ltd., and Ferguson Pailin, Ltd. It consists of two contra-rotational eight-unit insulator stacks per phase which at the top end support sphere and spade high pressure 4-point contacts, and at the bottom end are mounted on footstep bearings with taper roller races built into heavy section channel iron bases. Line connections are fitted to the contact heads, so constructed to allow the latter to rotate whilst the line connectors are held stationary.

The three phases are mechanically coupled to each other and to a motor driven hydraulic operating mechanism which comprises a motor driven gear pump supplying both ends of a double acting cylinder the piston of which has a rack cut into the centre part of its length, driving a pinion which rotates the output shaft in both directions.

It is appropriate here to outline the construction of the 275 kV supergrid and for easier reference we will describe it as if it were already completed (it has been planned

As planned for completion in 1960 the supergrid consists in the main of a ring of 275 kV lines through Yorkshire, Lancashire and the Midlands, with important spur lines to the north and south

for completion in 1960). It consists essentially of a central ring of lines embracing the Midlands, Lancashire and the West Riding of Yorkshire, with a connection northwards via the north east coast and Carlisle to Clyde's Mill in Scotland; two direct lines run to the London area joining a horse-shoe around London and terminating at Tilbury on the north bank of the Thames and at a point near Northfleet south of the Thames; a connection from the Midlands to the South-West and South Wales is provided by a line running south to Melksham in Wiltshire, with a further connection eastwards to the London area. All the 275 kV lines are of double-circuit construction with the exception of the single-circuit section from Staythorpe to West Melton.

The conductors are of steel-cored aluminium in two sizes of 0·175 sq in and 0·4 sq in equivalent copper section. The smaller size conductors are used for the lines where the primary function is for interconnection and the larger size where, in addition, the line is required for bulk transmission. In each case there are two conductors per phase with 12in spacing.

The thermal rating of the 132 kV grid line is 90 MVA per circuit; compared with this the 275 kV lines with 0·175 sq in conductors have a rating of 375 MVA per circuit, the lines with 0·4 sq in conductors being rated at 570 MVA per circuit.

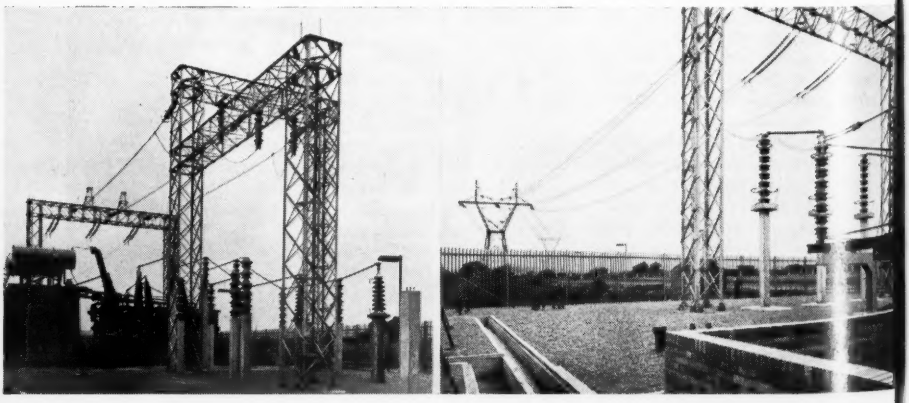
The towers of the double-circuit supergrid are similar in appearance to those which are so well known on the 132 kV grid. Two designs have been adopted, one for the twin 0·175 sq in conductors with a basic span of 1,000ft, and the other for the twin 0·4 sq in conductors with a basic span of 1,200ft. In both designs high tensile steel is used for the main members, resulting in an appreciable reduction in weight compared with mild steel and giving a more graceful appearance.

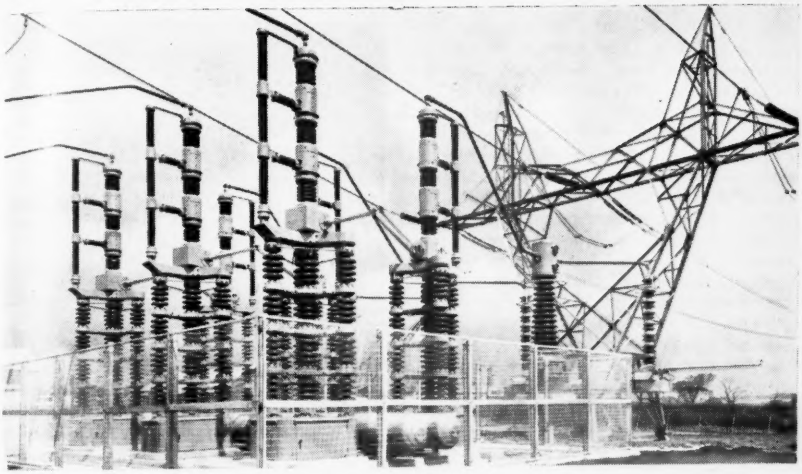
At the points of interconnection between the 132 kV and the 275 kV systems, auto-transformers are used, and the capacity of these has so far been limited to 120 MVA.

These transformers are three-phase units designed for operation with the neutral point solidly earthed and, to avoid the high cost of separate series-connected voltage regulators, on-load tap changing equipment is provided. Lower voltage delta-connected windings with one terminal earthed are included. It is the intention at a later stage of development to connect a number of generating stations directly to the 275 kV grid and this will necessitate the provision of double-wound transformers of not less than 120 MVA capacity, with the lower voltage winding arranged for direct connection to the generator. At a number of points, mainly on spur lines to power stations, 275 kV switchgear consists of isolators only; elsewhere there are 275 kV switching stations.

The 275 kV circuit breakers may be classified in the two distinct categories of bulk oil and air blast. For the closing operation of the bulk oil circuit breakers and

Left: **Staythorpe 275 kV substation; 275 kV auto-transformer in rear.** *Right:* **The Staythorpe-West Melton 275 kV line has a direct overhead connection with the Staythorpe supergrid substation**



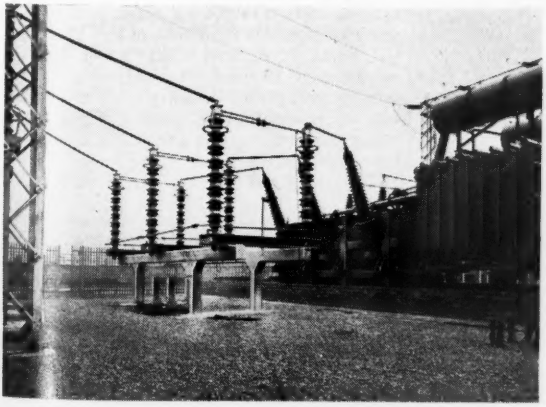


Direct switching at 275 kV is provided for at West Melton ; the 275 kV air-blast circuit breaker is installed on an experimental basis

general operation of the air-blast circuit breakers compressed air is used at 300–350 lb/sq in. The compressed air is supplied by duplicate three-stage compressors feeding a common storage at 650 lb/sq in. The air is distributed by a ring main system at the pressure required for c.b. operation.

All circuit breakers have a short circuit rating of 7,500 MVA achieved by the provision of four breaks in series per phase, each break being shunted by a linear resistance in the bulk oil pattern, and by six interruptor heads per phase in the air blast. The thermal ratings of the circuit breakers correspond to the overhead line ratings of 800 A and 1,200 A. Provision has been made for the future application of high-speed three-phase auto-reclosing. Manufacturers who are supplying 275 kV switchgear to the Authority have agreed on a common isolating switch design. These switches are of the two-post type and are arranged for power or emergency manual operation. Each insulator post of the isolator consists of eight anti-fog units and is similar to the insulator posts used generally for substations.

The 132/275 kV auto-transformer at the Staythorpe substation is rated at 120 MVA



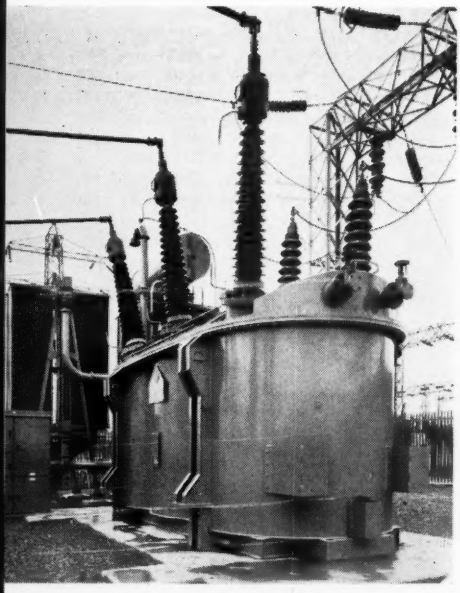
In the design stage consideration was given to a high type substation layout to save ground space, but in view of the difficulties in maintenance inherent in this design it was abandoned in favour of the low type layout. This layout uses reinforced concrete structures with a height of approximately 42ft to the highest point of suspension. The substation busbars are copper-clad steel tube, 3in in overall diameter, with a current rating of 1,200 A,

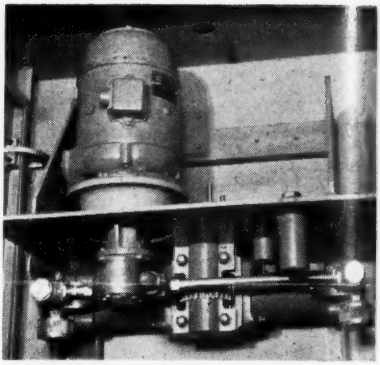
and the normal distance between supports is 27ft 6in. The flexible connections in substations have an overall diameter of 1·375in and consist of single hollow stranded conductors on a spiral core. Much design and experimental work is necessary in the development of the plant and equipment for a project like the supergrid, and such work has called for close co-operation between the staff of the Authority and their consulting engineers, Messrs. Merz & McLellan and Messrs. Kennedy & Donkin on the one hand, and the principal British manufacturers on the other hand.

The adoption of 275 kV is another great step forward which will help British consultants and manufacturers to maintain their place in the field of high voltage developments overseas. Developments in many parts of the world demand higher and higher voltages; 220 kV is in widespread use and 380 kV has been in commercial operation in Sweden for nearly two years. In the U.S.A. some 330 kV lines are in operation and there is talk of a "500 kV supergrid."

The prospects of even higher voltage

The grid and supergrid connection at West Melton is also via a 120 MVA 132/275 kV auto-transformer





The 275 kV isolators in the Staythorpe and West Melton supergrid substations are operated by motor-driven hydraulic mechanism

transmission in Great Britain may be offset economically by the comparatively short lines at home and technically by the climatic and atmospheric conditions here, but these difficulties will not be allowed to shape the pattern of future transmission if continued examination of all the factors indicates that the adoption of still higher voltages would be economical and efficient, and it was in this spirit that the B.E.A. decided to make reasonable provision for the future by designing the towers on the bulk transmission sections of the scheme for later operation at a voltage of 380 kV. The need for this higher voltage is not likely to arise for some years, but if bulk transmission requirements should approach the maximum levels envisaged, a transmission voltage of 380 kV might well prove more economical than that of 275 kV.

It was considered that it would be extravagant to make the supergrid substations suitable for future 380 kV working, but wherever possible space is being provided adjacent to the 275 kV substations for future installations.

The principal manufacturers and contractors supplying equipment for the supergrid are as follows:—

Switching and transforming station plant and equipment: Bruce Peebles & Co., Ltd., the British Thomson-Houston Co., Ltd., Crompton Parkinson, Ltd. (British Electric Transformer Co.), the English Electric Co., Ltd., Ferguson Pailin, Ltd., Ferranti, Ltd., the General Electric Co., Ltd., Hackbridge & Hewittic Electric Co., Ltd.,

Metropolitan-Vickers Electrical Co., Ltd., C. A. Parsons & Co., Ltd., and A. Reyrolle & Co., Ltd.

Overhead line construction: Balfour Beatty & Co., Ltd., British Insulated Callender's Construction Co., Ltd., J. L. Eve Construction Co., Ltd., W. T. Henley's Telegraph Works Co., Ltd., and Watsham's, Ltd.

At the inauguration of the first section of the supergrid at Staythorpe Sir John Hacking brought the 42 mile long line into commission by closing, under remote control, the 132 kV circuit breaker controlling the 132/175 kV auto-transformer. An illuminated operational diagram of the circuit was used to give meaning to what was taking place, and the diagram embraced actual measuring instruments for voltage and load. In the first place, however, Mr. L. F. Jeffrey, B.Sc., M.I.E.E., divisional controller, East Midlands Division, B.E.A., prepared the way for Sir John by closing, under instructions from Birmingham Grid Control, the appropriate isolating switch. Communication was maintained throughout the inauguration ceremony with Birmingham Grid Control and a near normal routine procedure was followed, including the amusing, although realistic, incident of Mr. Jeffrey appointing Sir John an "authorized person" for the purpose of closing the 132 kV oil circuit breaker. The ceremony was completed by Sir John uncovering an inscribed plate on the 275 kV transformer. Before doing so Sir John said that while the 275 kV grid would put electricity supply in this country in the van of progress, the main point about it was that it would provide a much greater pool of reserve generating plant.

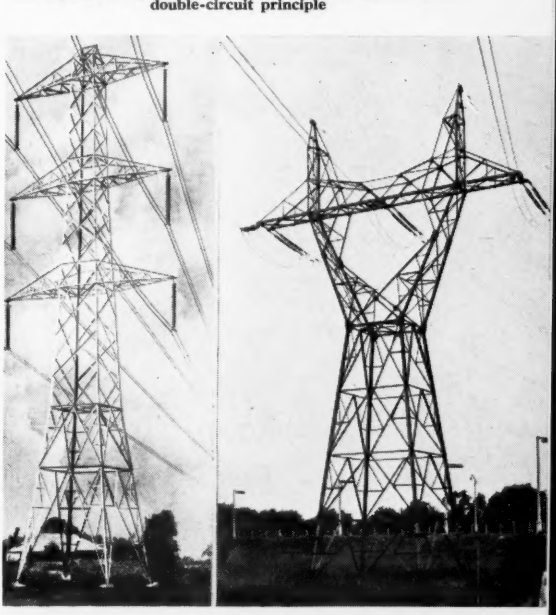
Mr. V. A. Pask, M.I.E.E., chief engineer, B.E.A., pointed out that it was appropriate that Sir John should perform the inauguration for he had been "in" on the supergrid right from the initial stages when it was only an idea in the minds of a few.

At lunch following the ceremony Mr. Jeffrey referred to the immense work put into the supergrid scheme by the electrical manufacturers.

Col. B. H. Leeson, C.B.E., T.D., M.I.E.E., President of the Institution of Electrical Engineers and Director of the British Electrical and Allied Manufacturers' Association, amusingly visualized the establishment of the supergrid as a military operation. It was, of course "Operation Hacking" well conducted by the "Pask Force." He said it was refreshing and stimulating to see such a scheme *not* based on short-term policy. They had seen inaugurated something that would increase the country's productivity for 50 years or so.

Mr. T. G. N. Haldane, M.I.C.E., M.I.E.E., of Messrs. Merz & McLellan, in congratulating the B.E.A. on all that had been done to bring the supergrid into service, referred to the pioneer work of the late Sir John Snell, Sir Archibald Page, Sir Andrew Duncan and others. He thought the difficulties before the establishment of the 132 kV grid were greater because of the wider clash of interests—public and private. He expressed appreciation of the extent to which the B.E.A. was using the services of consulting engineers.

With one exception, the Staythorpe-West Melton line (right), the supergrid is planned for construction throughout on the double-circuit principle



Domestic D

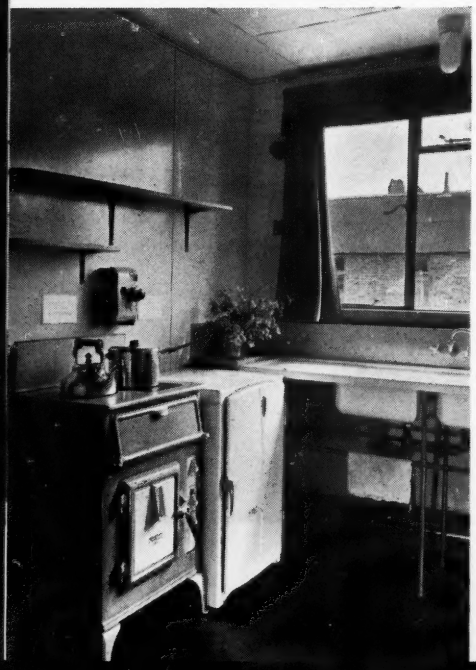
Importance of the Cooking and

THE statement by the Minister of Fuel and Power on the lifting of the ban on promotional publicity, made during the recent debate on rural electrification in the House of Commons, has focused attention on the important subject of domestic development about which all too little has been heard in recent years. Domestic development received a severe check from load shedding and load spreading, a check which was out of all proportion to the actual inconvenience suffered by domestic consumers.

The Boards' competitors were not slow to take advantage of these difficulties, and one can hardly blame them for that, but the ban on promotional publicity has prevented the Boards from stating their case properly to the public. The electricity supply industry has observed the restrictions rigidly—and rightly so—but has suffered in consequence. This has been the harder to bear in the knowledge that development of the domestic load is essential for a healthy revenue account and that without it the tariffs for all classes of consumers would inevitably be forced upwards.

Consumers have been led to believe that it was against the public interest to install electric cookers and water heaters and yet it was not these appliances which caused the peak problem—nor was it to any extent domestic radiators—but, in the main, space heating requirements in industrial and commercial premises consequent on the difficulty of obtaining suitable solid fuel.

Simple hire of electric cookers is necessary to compete with the cheaper cookers available in the gas industry



The average after-diversity demand of an electric cooker has been shown by tests carried out in various parts of the country to be about 0·25 kW and that of an immersion heater of the order of 0·15 kW and the consumption of the former is usually about 1,000/1,500 kWh per annum and of the latter 1,000/3,000 kWh per annum—invaluable loads which must be fostered again now that promotional publicity is possible.

A simple example will serve to illustrate the importance of the cooking and water heating loads. Many Boards are concerned about the low revenue obtained from housing estates where the local authorities are not giving their tenants the freedom to choose electric cooking and water heating where desired. In the East Midlands Area costs taken out on a housing estate in one of the cities showed that the average capital cost of supplying a house was £55 and that the gross revenue was £5 16s per annum per consumer. Bearing in mind that approximately two-thirds of the gross revenue is required to defray the cost of the bulk supply, this leaves less than £2 per annum for interest, depreciation etc., on the £55—a totally inadequate figure.

The installation of electric cookers would double the gross revenue from those houses equipped with them and the installation of cookers and water heaters would treble it—quite a different proposition. It is essential that the Electricity Boards get a fair proportion of these loads on housing estates and more and more housing authorities are beginning to realize the justice of giving "freedom of choice" to their tenants. In any case now that

Development

and Water Heating Loads

By N. F. MARSH*
M.A., M.I.E.E.

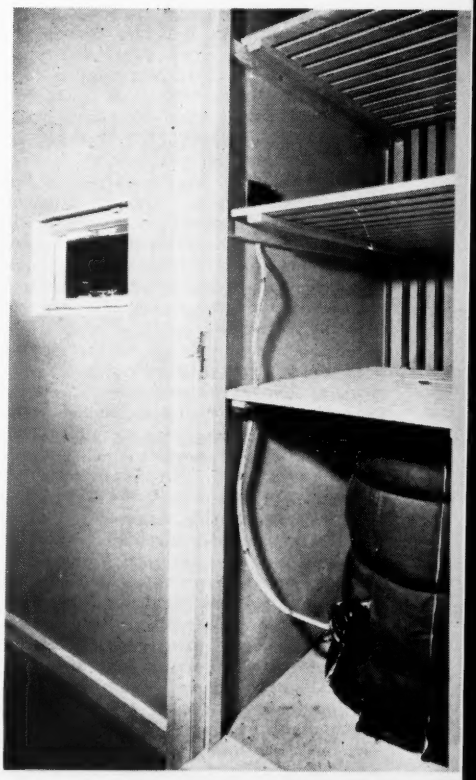
housing waiting lists are getting shorter, tenants will increasingly demand their rights in this matter.

The cooking and water heating loads are so important to the supply industry that they cannot be left to rest entirely on sales of the necessary consuming appliances—even with the help of hire purchase—and it is essential to back up sales by a suitable system of simple hire.

In the case of cookers, simple hire is necessary in order to compete with the cheaper cookers available to the gas industry whose hire purchase instalments are about 40 per cent below those of the Electricity Boards (including wiring) in the lower price range. In the East Midlands Area, where there is a hire scheme operating and generally available to consumers, out of about 13,000 additional cookers put out on the system each year, roughly half are sold for cash or on hire purchase and the other half are hired.

Service Centre staff are encouraged to effect sales wherever possible in preference to hire, and it is safe to assume that if no hire were available the connection of additional cookers on to the system each year would not exceed 8,000. This position could doubtless be influenced by increasing the number of Service Centres and the sales force, but such action could easily become uneconomic, in which case it would soon be reflected in the electricity tariffs of the Board.

As much of the cooker business as possible should be in the form of cash sales or hire purchase and to this end simple hire models should be functional in design so as not to encroach on the sales field—they should have a first-class cooking performance but should be finished in grey vitreous enamel, mounted on legs and designed with an eye to low maintenance, bearing in mind the relatively rough treatment some of these cookers will get. Manufacturers should keep these important points in mind when producing new cookers if they wish to participate in future simple hire business: there is a tendency for them to try to satisfy both markets—simple hire and sales—with identical cookers, but this policy could only result in an increase in hire and a decrease of sales. Such a result is not desired by the Boards operating simple hire schemes because there is obviously a practical limit to the amount of capital



Business in the hire of immersion heaters can readily be obtained at rentals which cover all the outgoings

* Chief Commercial Officer, East Midlands Electricity Board.

which can be allocated to such schemes. Many local authorities do not provide cookers in their tenants' houses but leave the tenants to make their own arrangements with the Electricity or Gas Boards, and in these circumstances simple hire is essential. For housing estates, and indeed for other domestic consumers, it is also desirable to hire washboilers, since consumers often look either to electricity or gas for both services. Washboilers for hire should be simple and robust with galvanized finish, and the more elegant models should be left to cash sales and hire purchase.

The question of simple hire of cookers has received a good deal of attention lately, and it is not proposed to go into the economics in detail in this article. Instead there follows a brief examination of the water heating load, which is of equal importance with cooking in building up the domestic revenue.

Electric water heating has received a setback over the last fourteen years, first owing to the war, when materials were not available, and later due to the imposition of the heavy purchase tax, which has largely frustrated the storage water heater business.

The immersion heater business has, however, recently received a fillip from the efforts of manufacturers to produce a reasonably priced article with a modified type of temperature control device. Immersion heaters can now be purchased for £5 or less, including purchase tax, and the time is ripe, therefore, to push ahead with the further development of this load.

In the case of immersion heaters, as with cookers, simple hire is essential for successful development, but for a different reason. The immersion heater is more than competitive with anything the Gas Boards can offer, but consumers who do not own their houses have a deep-rooted objection to buying water heater installations which become part of their landlord's property and cannot very well be removed at the end of their tenancy.

The need for simple hire of immersion heaters is demonstrated by the scheme recently introduced in the East Midlands. A number of the former undertakings hired immersion heaters and at vesting date there were some 30,000 on hire. Most of these schemes were suspended during the war and had not been restarted since. On 1st May, 1953, the East Midlands Board recommenced the simple hire of immersion heaters under a standard scheme applicable to the whole Area and by the end of June (two months only) 4,000 applications had been received, whereas prior to the launching of the scheme the average number of jobs carried out on a cash or hire purchase basis was not more than 100 per month. Very little publicity has been given to the scheme, other than reports in the local Press following a meeting of the Consultative Council. The demand will not, of course, continue at the rate experienced during the first two months and is, in any case, of a seasonal nature. However, the installation of 4,000 immersion heaters means the consumption of at least 4,000,000 kWh per annum, a timely reminder of the importance of this load.

Those who are worried about the economy of simple hire schemes need have no qualms about the hire of immersion heaters — the business can readily be obtained on rentals which cover all the outgoings as the following figures will show:—

	£ s d	£ s d
Cost of immersion heater and lagging jacket ..	7 0 0	
Wiring, switches and plumbing..	6 5 0	
	£13 5 0	
Annuity on £13 5s 0d at 4½ per cent for 15 years		1 4 3 p.a.
Maintenance		6 0 „
Office charges, say ..		4 0 „
		£1 14 3 „

=8s 7d per quarter or say 8d per week, which is the actual rental used in the East Midlands scheme in cases where the wiring is provided by the Board. The figure included for wiring and plumbing is high enough to permit this work to be handed to outside contractors where desirable.

No stone should be left unturned in the drive for domestic development. The co-operation of the electrical contractors should be sought in the matter of increasing sales of load-building appliances, particularly electric cookers, for which the Boards are recognized as the principal sales outlet. The Boards can further this co-operation by placing some of the wiring of cookers in the hands of outside contractors, even where they operate their own contracting departments.

A final point with regard to the promotional publicity which is now getting under way. The recent debate in the House

disclosed some anxiety about the possibility of conflicting publicity from the gas and electricity industries which might cause public criticism. Although gas is a strong competitor of electricity in some fields, it is too readily assumed that business obtained by electricity is necessarily at the expense of gas and vice versa. It should be remembered that much of the summer cooking and water heating load is supplementary to the use of solid fuel in the winter, and it is therefore quite proper for both industries to strive, by publicity or otherwise, for a share of this supplementary load, which is necessary to both of them. It is difficult to see why such action should be criticized.

Very High Steam Pressure

American 4,500 lb/sq in Plant

FURTHER particulars of the 4,500 lb/sq in generating plant which, as recently reported in the *Electrical Review*, is to be installed by the Ohio Power Co. in its Philo station are given by Mr. Philip Sporn in the *Electrical World* of 29th June. The 125 MW 3,600 r.p.m. tandem turbine will have throttle steam conditions of 4,500 lb/sq in and 1,150 deg F, double steam reheating and seven stages of feed water heating. Since this pressure is above the critical value of 3,206 lb/sq in, steam will be raised in a " once-through " unit consisting of several thick small-diameter tubes in parallel, varying in composition from carbon steel at the inlet to stainless steel at the outlet.

To allow for a through pressure drop of 1,000 lb, feed water is to be pumped at 5,500 lb/sq in. The steam generator rating will be 675 k lb/hr at 4,500 lb/sq in and 1,150 deg F with reheating of 615 k lb at 1,150 lb/sq in from 800 to 1,050 deg and 525 k lb at 165 lb/sq in from 630 to 1,000 deg. About 81 per cent of the total heat input to fluid will be used in the main superheater or in the reheaters. Crushed coal will be fired through three cyclone furnaces. Steam pressure will be controlled by the discharge pressure of the feed pumps, instead of by the firing rate; the speed of the pumps will be controlled by a pressure regulator at the turbine throttle.

The exhaust from the high-pressure cylinder will be taken, after reheating, to the mid-section of an intermediate reverse flow cylinder, the exhaust from which, when further reheated, will be taken back to the mid section adjacent to the inlet from the first reheater. After doing its work here the steam will travel to a double-flow low-pressure cylinder.

The h.p. machine will have a double shell to allow the use of more readily available ferritic materials for the parts at lower temperatures instead of austenitic materials as required at the higher temperatures. The turbine from the first reheat point to the condenser will be fabricated from ferritic material. The generator will be cooled by hydrogen at 30 lb/sq in at maximum rating and its rotor may have hollow conductors for direct cooling.

An overall heat rate of 8,500 B.Th.U./kWh, equivalent to over 40 per cent thermal efficiency, is expected; this compares with the best performance in 1952 of 36·8 per cent at Tanners Creek power station of the Indiana and Michigan Co. The new set at Philo will occupy the space now taken by a 40 MW turbo-alternator operated at 600 lb/sq in and 710 deg F, which was installed in 1924, and is not expected appreciably to increase cooling water requirements.

Home Lighting

STRESSING the importance of good lighting, a booklet entitled " Your Home Lighting " issued by the E.L.M.A. Lighting Service Bureau shows that the cost of electric lighting has actually fallen during the past twenty years. Suggestions are given for the proper illumination of the various parts of the house and the different types of lamps are described. Single copies are available free of charge from the Bureau at 2, Savoy Hill, London, W.C.2, and quantities can be supplied at cost price.

Agricultural Shows

Electrical Displays at Royal Welsh and Sussex County Events

EVERY electrical aid for the farmer, the horticulturalist, the housewife, and the hotelier and restaurateur is included in a large display organized jointly by the South Wales Electricity Board and the Electrical Development Association at the Royal Welsh Show at Cardiff this week.

A special feature is a revolving stage on which Welsh actors and actresses enact scenes showing how life has been made easier in the home as a result of electricity. Adjoining this miniature theatre is a large display of domestic equipment where the public can examine the appliances used on the stage and the many more household aids that exist. Woman visitors to the Show are also evincing interest in the large demonstration theatre and cinema where throughout the day demonstrations of food mixing, cooking and home laundry by electricity are given by experts. A series of films is also being shown.

Commercial Catering

An innovation this year is a complete electrical commercial catering kitchen measuring 30ft by 20ft, which is fully equipped and staffed by the South Wales Electricity Board's demonstrators. Meals for the staff on duty on the Stand are being prepared in this kitchen, which is open for inspection by the public, and they will be served in an adjoining restaurant. Special invitations have been issued to hotel owners and managers, restaurateurs and café proprietors to inspect this electric kitchen and see for themselves the efficiency of commercial catering by electricity.

As is only fitting for an agricultural show, however, the main emphasis is on the use of electricity on the farm, to increase the production of foodstuffs and eliminate much of the hard work entailed. The equipment on view has been selected so as to appeal to the small, medium or large scale farmer and horticulturalist, and many of the appliances will be operating.

A fully operational electrically-equipped farm workshop demonstrates how electric machine tools, welding, etc., can help the farmer to carry out repairs to his implements without having to send them off the farm.

Marquee Blown Down

The success which the South Eastern Electricity Board achieved at last week's Sussex County Agricultural Show at Hassocks was undoubtedly well deserved in view of the difficulties which the staff had to overcome. Only a few hours after the display, which was practically a replica of that at the recent Kent Show at Maidstone (see 10th July issue, page 85), was completed on the Saturday preceding the opening, a gale blew down the marquee. Fifty-two hours' continuous work was required to replace the torn canvas and redecorate the interior, which was badly affected by the rain, and the Board's staff had the satisfaction of seeing the display looking " as good as new " in time for the opening on the Tuesday.

Even then the difficulties were not completely over. The rain has made a morass of the ground (to the great benefit of the enterprising wellington boot salesmen) and the Board is again to be congratulated on keeping its exhibit one of the driest places underfoot in the Show.

Apart from the Board's exhibit, a considerable amount of interest in electrical equipment was aroused by displays by manufacturers and agents. A comprehensive collection of milking machines, coolers, sterilizers, grain dryers, hedge trimmers, etc., was arranged by Louis G. Ford, Ltd., while H. J. Galliers drew special attention to waterproof fittings, safety earth leak trips, and wiring with indestructible insulation. Horace Fuller, Ltd., extended an offer to visitors, which we did not see accepted, to test for themselves the relative merits of three different types of electric fences. Refrigeration plant was shown by D. P. Toomey & Co., Ltd. (Frigidaire) and Fridgservice, Ltd. Western Incubators, Ltd., had a representative display of their products, and Hoover, Ltd., demonstrated its washing machines, vacuum cleaners, etc.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE triennial award of the Coopers Hill War Memorial Prize and Medal has been made by the Council of the Institution of Electrical Engineers to **Mr. G. Lyon,** M.Sc.(Eng.), A.M.I.E.E., for his paper on "Some Experience with a British A.C. Network Analyser." The prize, which consists of a bronze medal, a certificate and about £20 in money, is awarded for the best paper on a professional subject published by the Institution during the period of the award, but only authors who are corporate members under thirty-five years of age are eligible.

In our last issue we reported the appointment of **Mr. James Bennett,** contracts manager of A. Reyrolle & Co., Ltd., to the board of directors. We now reproduce Mr. Bennett's portrait.

Mr. J. Bennett

Mr. Ernest Hill, A.M.I.E.E., at present district commercial engineer, Wimbledon District, London Electricity Board, has been appointed commercial officer of the Dumfries and Galloway Sub-Area of the South West Scotland Electricity Board and will take up his duties on 1st August next.

The Brush Electrical Engineering Co., Ltd., announces that the **Hon. A. C. Geddes** has requested that, in order that he may be free to develop his personal business interests, he should be released from the present agreements whereby his services are available to the companies of the Brush group, and he has tendered his resignation as a director of the company.

Mr. J. N. Willsden has been appointed sales engineer with Siemens Electric Lamps & Supplies, Ltd., Leeds. He was formerly installation engineer with the Yorkshire Electricity Board No. 4 (Leeds) Sub-Area.

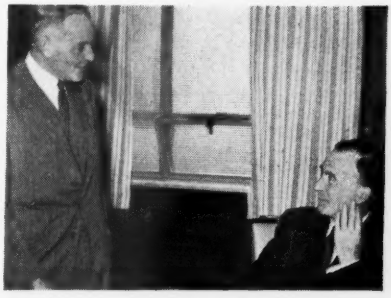
Mr. W. P. Warren, B.Sc., A.M.I.E.E., formerly senior assistant, industrial supply, in the Chief Commercial Officer's Department, at the head office of the South Wales Electricity Board, St. Mellons, has been appointed section head, industrial supply, in the same Department in succession to **Mr. D. G. Gwyn,** B.Sc., A.M.I.E.E., who was recently appointed manager of the Board's Western Sub-Area at Tenby. **Mr. C. V. Ball,** formerly district commercial manager, District 347 (Cardiff East), has been appointed commercial officer, Central Sub-Area at Cardiff, in succession to the late Mr. C. T. Martin, B.Sc., A.M.I.E.E.

Mr. F. L. Haxell has been re-elected assistant general secretary of the Electrical Trades Union.

The retirement of **Mr. S. M. Hills** after twenty-five years as editor of *Electrical Industries* was marked by a luncheon given by his contemporaries of the Old N'ions Association at the City Livery Club on Monday. Mr. J. Mortimer Hawkins, who presided, said that, as president of the Association he felt that no greater compliment could be paid to Mr. Hills than that nine past-presidents, together with many of his contemporaries from the Northampton Engineering College, should come to honour the toast that he was proposing. Mr. Hills, who was one of the founders of the Association in 1907, and president in 1912, suitably replied.

Submarine Cables, Ltd. (owned jointly by Siemens Brothers & Co., Ltd., and the Telegraph Construction & Maintenance Co., Ltd.), have presented the officers' mess of the Post Office cable ship *Monarch* with the latest edition of the Encyclopædia Britannica to commemorate the laying of the Netherlands-

Captain J. P. F. Betson (standing) talking to Mr. J. N. Dean



Denmark Submarine Telephone cables in 1950.

The presentation was made by Mr. J. N. Dean, chairman and managing director of the company, to Capt. J. P. F. Betson, master of the *Monarch*, at a luncheon party held recently at the Telcon Works. In making the presentation, Mr. Dean wished Captain Betson and the ship's company good luck on their forthcoming expedition to complete the renewal of the Atlantic telegraph cable for Cable & Wireless, Ltd., which was commenced last year. The *Monarch* is expected to be away for about two months and is at present loading approximately 1,525 nautical miles of cable at the Telcon Works for the renewal.

Mr. N. H. Codling, A.M.I.E.E., has been appointed editor of the *Electrical Journal* in succession to the late Mr. S. G. Rattee. Mr. Codling, who has been assistant editor, came to technical journalism from industry in 1948, having previously served for thirteen years on the staff of Standard Telephones & Cables, Ltd. His industrial experience also includes switchgear manufacture, lamp production and instrument work. He holds an honours diploma of Faraday House Electrical Engineering College, and in 1950-51 he was a member of the B.S.I. Technical Committee on Abbreviations and Symbols.

Mr. N. H. Codling

Mr. Ivan M. Waller, B.A., M.I.Mech.E., has joined the Lockheed Hydraulic Brake Co., Ltd., to assist, in the first instance, with the development of the Lockheed-Avery flexible pipe and self-sealing couplings division.

Mr. D. Maxwell Buist, M.I.E.E., M.I.Ex., export director of the B.E.A.M.A., has been re-elected chairman of the Council of the Institute of Export for the year 1953-54.

Mr. David R. Crabtree has relinquished his position with the sales department of Erinoid, Ltd., to become the technical service manager of Styrene Products, Ltd.

The annual sports day of the **Hotpoint Electric Appliance Co., Ltd.,** was held recently at Fletton, Peterborough, and attracted a crowd of 2,500. Publicity for the event included a decorated landau accompanied by figures in grotesque heads. These paraded the main streets of the city. A small fair, with roundabouts, swing boats, etc., was a popular attraction, and the Peterborough city band, a display of Maypole dancing by schoolchildren and trick motor-cycling were included in the programme of entertainment, and in the evening there was a firework display which included giant set pieces with the company's slogan, "Hotpoint for every Home," picked out in hundreds of points of flame against the darkening sky.

On 4th July the Sports Club of the **Rheostatic Co., Ltd.,** entertained the Igranic Electric Co.'s Sports Club at their ground at Farnham Park. This meeting is an annual one between these two companies and since 1946 cricket and tennis competitions have been played in alternate years on each other's grounds, the teams competing for a cricket cup presented by Mr. D. W. Kent of the Igranic Electric Co., Ltd., and for a tennis cup presented by Mr. T. N. Flight of the Rheostatic Co. The result of the matches this year gave the cricket cup to Igranic and the tennis cup to Rheostatic.

Good weather favoured the annual sports day of **E. K. Cole, Ltd.,** which was held on 11th July. A large number of spectators were attracted to the meeting which included several Essex county women's and county cycling championships as well as the Ekco Athletic Club and children's events. The inter-departmental competition resulted in a win for the offices over plastics and radio. Mrs. E. K. Cole presented the prizes at the conclusion of the events.

The annual sports and gala of **Johnson & Phillips, Ltd.,** was held at the company's sports ground at Kidbrooke last Saturday. In spite of heavy rain the enthusiasm of the competitors and crowd was remarkable. The prizes were presented by Mrs. Wates, wife of Mr. G. L. Wates, J.P., the chairman of the company.

Mr. Walter Richards, senior director of Johnson & Phillips, Ltd., in Australia, and his wife, arrived at Tilbury last Monday on the

Mrs. Wates presenting the prizes at the Johnson & Phillips sports and gala

Strathmore. He will be staying in this country for several months. **Mr. C. Eric Stewart**, M.I.E.E., manager for Johnson & Phillips, Ltd., in India, Burma and Ceylon, and **Mr. Stanley Badcock** of the J. & P. South African subsidiary company, are also staying in this country until the end of August. Anyone wishing to get in touch with them may do so at the company's Victoria Works, Charlton, London, S.E.7.

OBITUARY

Sir Johnstone Wright, M.I.C.E., M.I.E.E., a director of British Insulated Callender's Cables, Ltd., deputy chairman of British Insulated Callender's Construction Co., Ltd., from 1949 to 1952, and a former chairman of the Central Electricity Board, died at Guildford on 19th July at the age of seventy.

The late Sir Johnstone Wright

Sir Johnstone was educated at Perth Academy and the Royal Technical College, Glasgow, and received his engineering training with Duncan Stewart & Co., Glasgow, and the British Electric Plant Co., Alloa. From 1905 to 1919 he was mechanical engineer and power station superintendent to the Cleveland & Durham Electric Power Co., following which he went to Bradford as deputy city electrical engineer. In 1922 he was appointed city electrical engineer and general manager at Belfast, and in 1927 he joined the Central Electricity Board as deputy chief engineer, becoming chief engineer in 1933, general manager in 1944, and chairman in 1947.

Sir Johnstone was a past-president of the Institution of Electrical Engineers (1939-40), and was a member of the Organizing Committee set up in 1947 preparatory to nationalization of electricity supply. He was a director of Thomas Bolton & Sons, Ltd., and was knighted in 1943.

Mr. E. Fawssett.—The death has occurred at his home at Riding Mill, Northumberland, of Mr. E. Fawssett, a well-known electrical engineer in the North East area. Mr. Fawssett served with the North Eastern Electric Supply Co., Ltd., from 1901 to 1945 and was testing manager for many years.

Mr. J. V. Chaplin, Colwyn Bay sub-district commercial officer, Merseyside and North Wales Electricity Board, until his retirement two years ago, died last week, aged sixty-five. Prior to nationalization he was borough electrical engineer and manager to the Colwyn Bay Council.

Mr. F. G. Curel.—The death is reported of Mr. Frederick Grant Curel, who was for forty years manager and engineer of the Witney U.D.C. Electricity Department. After nationalization he continued as local engineer and manager with the Southern Electricity Board until he retired in 1950. He was seventy-eight.

Mr. John Edward Fisher, chief charge engineer of the English Electric Co., Ltd., for the construction of a power station at Vierfontein, Orange Free State, was killed in a motoring accident on 3rd July in Johannesburg.

WILLS

Mr. A. L. De Lattre, M.I.E.E., formerly assistant engineer-in-chief of the G.P.O., who died on 23rd April, left £4,924 gross (£4,851 net).

Mr. H. M. Froud, M.I.E.E., late chief commercial engineer to the Westinghouse Brake & Signal Co., Ltd., who died on 30th March, left £6,892 gross (£6,766 net).

Mr. F. P. Best, M.Sc., B.Eng., A.M.I.E.E., technical manager of the Marconi International Marine Communication Co., Ltd., and of the Marconi Sounding Device Co., Ltd., who died on 27th March last, left £6,884 gross (£6,199 net).

Mr. A. L. Lunn, M.I.E.E., M.I.Mech.E., electrical engineer (generation) London Transport, who died on 2nd May last, left £3,140 gross (£2,754 net).

Mr. H. F. L. Dixon, A.M.I.E.E., who died on 12th January last, left £5,768 gross (£5,526 net).

Mr. J. L. L. North, sales director of Static Condenser, Ltd., who died on 31st March, left £3,578 gross (£3,089 net).

Mr. R. B. Maurice, electrical superintendent at Earley power station, who died on 20th February, left £3,493 gross (£2,908 net).

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Safety First" fused plugs.
"Reynolds" electric irons.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Illuminating Engineers

Summer Meeting at Nottingham

THE Midlands Area of the Illuminating Engineering Society held a one-day summer meeting at Nottingham University on 10th July, the twenty-fifth anniversary of the inauguration of the buildings by King George V. In an opening address, Mr. W. J. Wellwood Ferguson (president, I.E.S.) explained that previously all meetings had been on a national basis, lasting three or four days, but as this was not always convenient to many members the Centres of the Midlands Area had organized the present conference with the approval of the Council of the Society.

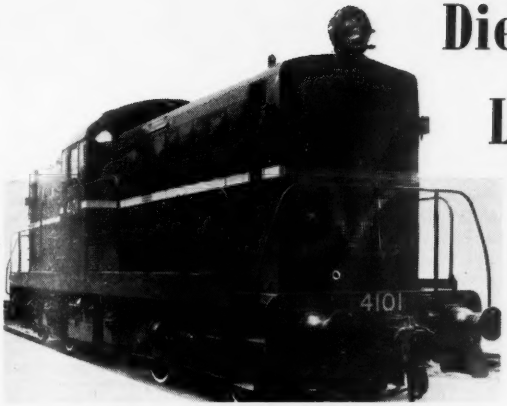
Use of Colour

A paper on "Colour in Pictorial Art" was presented by Professor H. Cotton, who referred to colour as not merely a narrow band in the electro-magnetic spectrum between 4,000 and 7,500 Angstrom units, but also a science in its own right. He pointed out that the use of colour entailed a knowledge of its limitations as well as of its possibilities and showed by numerous lantern slides how painters had achieved their effects.

In a second paper on "Eye, Nerve and Brain," Mr. H. Asher described experiments (also illustrated by slides) which were being carried out and their results, the essential nature of the processes involved not yet being fully understood. Lines of research which originally seemed separate were now known to be coming together. This was exemplified in Herings' unification of contrast and simultaneous adaptation. Recently, due largely to Pirenne, the close relationship between visual acuity, retinal interaction and dark adaptation had come to be recognized. The chief unifying concept between diverse phenomena was an inhibiting process, which might also be found to apply to a mutual pathological suppression of colour among different chromatic mechanisms which produced a sensation devoid of colour, namely white.

At the luncheon the chairman of the Nottingham Centre, Mr. P. L. Ross, presided. Mr. W. J. Wellwood Ferguson proposed the toast of the City of Nottingham, to which the Lord Mayor, Councillor C. Coffey, responded. At the dinner the president took the chair, when Mr. H. C. Weston (hon. sec., I.E.S.) proposed "the University," Professor Cotton replying, and Mr. H. Asher proposed "the Society," to which the president responded. The conference programme included visits to Newstead Abbey and the works of the Boots Pure Drug Co.

Members of the organizing committee, Midlands Area, Illuminating Engineering Society



Diesel-Electric Locomotives

Heavy Freight Haulage in New South Wales

LAST week there was a demonstration at the Birmingham works of the Metropolitan-Cammell Carriage and Wagon Co., Ltd., of one of ten 1,000 h.p. switching and shunting locomotives which the British Thomson-Houston Co., Ltd., has on order for the New South Wales Government Railways. As they are required to shunt and haul very heavy freight trains, these locomotives are designed for a tractive effort of 51,000 lb at starting and 22,800 lb continuously. The maximum permissible road speed is 57 m.p.h. which will enable the locomotives to be used for hauling passenger and mixed traffic trains at comparatively high speeds. The usefulness of these locomotives is enhanced by the fact that two separate 500 h.p. engine-generator sets are employed and at times of light load one set only need be run.

The complete design and layout of these 80 ton locomotives has been achieved by collaboration between the B.T.H. Co. and the Metropolitan-Cammell Carriage and Wagon Co., in whose Birmingham works the mechanical parts have been made and the locomotives assembled and tested. The diesel engines have been supplied by Davey, Paxman & Co., Ltd., and the electrical equipment by B.T.H.

As the driving cab is central in the locomotive the driver has excellent visibility, irrespective of the direction of running, while the provision of dual controls enables him to operate from either side.

There are two engine-generator sets, complete with radiators, one set being arranged at each end. The layout is symmetrical except that next to the cab at one end is the control frame while at the opposite end is housed the electrically driven compressor. Each engine-generator set is on a common bed, the latter being supported on the main locomotive frame through " Neo-K-Tex " pads and resilient mountings. The whole power unit is under a " bonnet," the sides comprising hinged doors which lift off, leaving the skeleton structure only, thus giving

General view of driver's cab

maximum access for maintenance. A large section of the roof is removable to enable a complete engine-generator set to be lifted out and alternatively a local portion immediately above the engine cylinders can be removed for overhauling the engine in position. A further local section is also removable for changing the compressor or alternatively for attention to the control frame.

The engine air intakes draw air through the roof and then upwards through Visco air filters mounted in a horizontal position. The air is then ducted through flexible connections to the manifolds. The filters can be withdrawn through the sides of the roof and are accessible from the side "walkways." Special silencers to the railway authority's requirements are mounted under the centre portion of the roof, with flexible connections to the engine exhaust manifolds.

Under each bonnet are two electrically driven motor blowers, each blower providing air for forced ventilation of the adjacent traction motor through ducting forming part of the main frame structure and a flexible connection between the frame and bogie-mounted motor.

The main frame is an all-welded structure comprising rolled steel sections, plates, and fabricated units covered by a steel floor plate provided with trays to allow surplus oil to drain through pipes clear of the equipment below the frame. The bogies are of the four-wheeled type, of a fabricated all-welded construction, and have swing bolsters. Both axles of each bogie are driven by B.T.H. series wound axle-mounted motors through heat-treated steel gearing, the gearwheel being of the resilient type which permits a degree of torsional resilience between the wheel centre and the toothed rim. The motor nose suspension is through links and "Silentbloc" bushes to the bogie crossbars. The motors are series wound and are forced ventilated by motor-driven centrifugal blowers. Class B insulation is used throughout.

The engines are Paxman 12 RPHL Series II, each of 500 h.p. and run at 1,250 r.p.m. The main generator is specially designed for the severe duties associated with diesel-electric traction service and is a single-bearing machine having a self-aligning roller bearing at the commutator end; the other end of the armature is solidly coupled to the engine crankshaft. The fabricated steel magnet frame combines maximum strength with light weight and it carries supports on which are mounted the auxiliary generator and overhung exciter. These machines are driven by V-belts from a pulley mounted on an extension of the main generator shaft.

As previously mentioned, the controls in the driver's cab are duplicated, and therefore at each of the driver's control positions is a control unit comprising power controller, key-operated reverse drum, and instrument panel. The reverser key is removable in the "off" position only and must be inserted in the control unit which is to be used to drive the locomotive. In addition to the "forward," "reverse" and "off" positions, the reverser key has an "engine only" position. This enables the engine to be run up and the control tested without applying power to the motors.

Coal Consumers' Reports

IN the sixth annual report of the Industrial Coal Consumers' Council, covering the twelve months ended 30th June, it is stated that since the setting up the Council in July, 1947, inland consumption in the United Kingdom has increased from 185·5 to 207·8 million tons per annum, while overseas shipments and bunkers have risen from 7·7 to 16·3 million tons. Certain qualities are becoming scarcer, particularly carbonizing coals and large coals for railway and domestic uses. The importance of summer stocking of coal is emphasized and it is hoped that the Banks will accommodate consumers to that end. The rise in coal prices by 10 per cent in March has resulted in complaints from the pottery and other industries in which fuel costs form a high proportion of total manufacturing costs. There has been difficulty in meeting the growing demands for blast furnace coke due to increased activity in the steel industry.

The Domestic Coal Consumers' Council recommends continuance of Government restrictions until more house coal is available and hopes the Minister of Fuel and Power will reconsider his decision against summer stocking if sufficient coal becomes available. A majority of Council members favour the selling of the poorest qualities more cheaply, even if this necessitates raising the prices of the best coals. The Council hopes that the idea of reducing the number of price zones will not be abandoned and that the proposals for improving coke marketing will be adopted. It deprecates the taxing of approved appliances if their efficiency is below Ridley Report standards and adds that too many out-of-date heating appliances are still being installed in new houses.

PARLIAMENTARY NEWS

By Our Special Reporter

DURING a debate in the House of Commons on Scottish industry, Mr. James Stuart, Secretary of State for Scotland, said that a Committee under the chairmanship of Sir Edward Appleton had for some time been investigating the possibility of developing Scottish peat deposits. Its report was in an advanced stage of preparation and meanwhile the Committee, with the support of Sir William Stanier's Gas Turbine Committee, had specifically recommended that the North of Scotland Hydro-Electric Board should set up an experimental peat-burning power station at Altnabreac, Caithness, with assistance from the Development Fund. He was very glad to say that this recommendation had been accepted by the Development Commissioners and the Treasury, and the project would be put in hand at once.

The plant would consist partly of a 2,000 kW closed cycle gas turbine of the type developed by John Brown & Co., of Clydebank. The North of Scotland Hydro-Electric Board and John Brown & Co. had been working on the closed cycle gas turbine since 1947 and an oil-burning turbine of this type, the first in Great Britain, was expected to be in operation at Carolina Port, Dundee, in three or four months' time. A pilot gas turbine burning dried peat had also run for 1,000 hours at Clydebank with promising results, and the new peat plant would be a development of this. In addition, the scheme would include a 750 kW open cycle turbine which had been manufactured by Ruston & Hornsby, of Lincoln, to the order of the Ministry of Fuel and Power out of a grant from the Development Fund and would be installed as soon as it had completed the necessary tests and was in full working order. The whole pilot scheme was expected to take three to four years to complete.

All the previous experimental costs had been borne from the Development Fund. The capital and development costs of the present scheme, estimated at approximately £500,000, would be met mainly from the Development Fund, with contributions from the Hydro-Electric Board and the British Electricity Authority, and the running costs would be borne by the Hydro-Electric Board.

If this scheme were successful it was the intention of the Hydro-Electric Board to proceed with larger schemes on a number of bogs in the Highlands. This would make an immense difference to the economic outlook for the Highlands in that not only would the peat schemes themselves provide a most welcome addition to our fuel and power supplies and employment in areas where it was badly needed, but if excavation supported the evidence of preliminary borings they could look forward to the reclamation of large areas of land for agriculture and forestry after the peat had been cleared, providing a permanent livelihood for a larger population. It was estimated by the Peat Committee that approximately 600 million tons of peat solids were available in Scotland in areas where depth, accessibility and other features made them suitable for utilization. Of these, Caithness and Sutherland contained approximately 130 million tons. Should the experiment in Caithness succeed, the Hydro Board estimated that further plants in Caithness and Sutherland alone might provide employment, part-seasonal and part-regular, for 400 to 500 men. He was sure the House would agree that Sir Edward Appleton's Committee, the Hydro Board and the Ministry of Fuel deserved to be congratulated on this project, and he would like to express his thanks to the Development Commissioners and the Chancellor for the support they had given to it.

Electricity on Farms

Sir Leonard Ropner asked the Minister of Agriculture what proportion of farms in Yorkshare were supplied with electricity: and how many applications from farmers for a supply were at present outstanding.

Sir Thomas Dugdale said he was informed by the Area Electricity Boards concerned that just over 40 per cent of farms of 5 acres and over in Yorkshire were connected to the public electricity mains at 31st March last. There were about 2,590 outstanding applications from farmers in the county.

African Water Power

Replying to a debate on colonial development, Mr. Lyttelton, Secretary of State for the Colonies, said that they were only at the beginning of hydro-electric power expansion in Africa. The plan for the Owen Falls scheme was for ten generators each of 15,000 kW, of which one was due to operate in October and the next five at intervals of three or four months. The Queen had graciously agreed to inaugurate the scheme in April, 1954. In the area of the proposed Central African Federation there were the Kafue and Kariba schemes which were on a very large scale. Discussions were still proceeding on the matter of the priorities of these two projects.

Probably they would be resolved by the Federal Government. A preparatory commission was also at work on the Volta River scheme which, when completed, would generate more than 500,000 kW.

Referring to steam-generated electric power, he said that the Connaught Bridge scheme in Malaya was now operating at 40,000 kW capacity and it would rise to 80,000 kW. At Singapore the Pasir Panjang power station was planned to produce 150,000 kW and it was now producing 50,000 kW.

Science and Productivity

Opening a debate on science and industrial productivity, Mr. Stokes said that industry was left with too little capital to carry out desirable development. Other points he made were that there should be more inducement to workers to become skilled, and that the Government was not doing enough to encourage fuel saving in industry.

Mr. Shackleton said that the part played by the individual inventor must not be overlooked. It was easier to get new inventions tried out in the United States than in this country. The real problem was to get the new results of scientific development over to the boards of directors and to others in charge of industry.

Mr. Palmer said the cause of the shortage of professional engineers and technologists was to be found in the whole bias and the continued assumptions of our educational system—that knowledge itself was divine, but the application of it just mortal. The result of that attitude was that although the pure or research scientist was now received into the charmed circle of the respectable professions, the engineering technologist was still not sure of his welcome. It was in the large units that the need of engineers and technologists was so important. The solution was the creation of several technological universities.

Mr. Molson, Parliamentary Secretary to the Ministry of Works, deplored the fact that manufacturers did not take a wider interest in scientific use and research. He said that the Ministry of Fuel and Power had already embarked on the development of three interesting new ideas: a gas turbine run on peat, a gas turbine run on coal, and a large heat pump for heating the Festival Hall in winter and cooling it in summer. Further, the British Electricity Authority, in collaboration with the Building Research Station, was developing the manufacture of bricks from the ash of power stations.

Mr. Lee said the Government was not investing anything like the amount of national wealth in research which was necessary. Progress, however, did not depend solely on Government action: there should be a better response from both sides of industry. The trade unions should consider formulating educational schemes under which those who displayed ability above the average should have the opportunity of going to a college or university for technological studies related to their own industries.

Sir Walter Monckton, Minister of Labour, said that one of the chief obstacles to the rapid introduction of new and more efficient processes lay in the fact that many employers refused to consider reorganization because they were afraid of the resistance which might be aroused among the workers. Thus they hesitated to disturb the traditional practices which had grown up around the old-fashioned ways of doing the job. It was fairly easy to convince the worker or the employer that higher productivity was desirable for the economy as a whole. What was not so easy was to satisfy him that he might have to change his job or reorganize his own business.

Railway Electrification

Mr. Sparks asked the Minister of Transport what progress had been made in the past five years in the electrification of railway lines.

Mr. Lennox Boyd said that on British railways the electrified line from Liverpool Street to Shenfield, with the associated branch from Fenchurch Street to Stratford, was opened to traffic in November, 1949. The Manchester-Sheffield-Wath scheme was under construction and was partly completed. Other schemes were in contemplation. During 1948 and 1949 the London Transport Executive electrified and absorbed a total of 16·89 miles of existing surface lines in completion of the extension of the Central Line.

Mr. Sparks said that practically the whole of the electrification was now centred in the Southern Region. Could the Ministry impress on the British Transport Commission the need to extend the system to other Regions?

Mr. Lennox Boyd said he was sure the Commission would read the question and answer. The only agreed proposal put to the Ministry was for the electrification of the Fenchurch Street to Southend line, and he had given his consent.

When Mr. MacLeod spoke of the need for railway electrification in the North of Scotland, thereby using the power supplied by the Hydro-Electric Board, Mr. Lennox Boyd said that might well come.

Sulphuric Acid Supplies

Sir Arthur Salter, Minister of Materials, said that at the present time 30 per cent of the sulphuric acid in this country was made from home produced materials.

Iron and Steel Institute

A special meeting is being held by the Iron and Steel Institute in the Netherlands from 30th September to 7th October. The programme will include visits to Amsterdam, Ijmuiden, Utrecht, Delft and Rotterdam.

VIEWS on the NEWS

By REFLECTOR

SOME people execrate the grid towers; most people tolerate them; but extremely few praise them. One of the few is the Rev. George Hill, of Rye Harbour, Sussex, who in a letter to *The Times* maintains that "their graceful lines paradoxically fit the countryside as much as the new annexe fits the ancient Westminster Abbey." Moreover, Mr. Hill also sees beauty in what has been called the "cat's cradle of overhead wires" in his village street, finding their geometric pattern against the sky to be quite fascinating. No doubt the B.E.A. and Electricity Boards could wish all witnesses at overhead line inquiries to be as sympathetic as this.

* * *

Not surprisingly, another correspondent Mr. H. G. Griffin of Grasmere, asserts that few will be found to share Mr. Hill's enthusiasm for the average village "wirescape." Mr. Griffin says that the extra cost of placing lines underground was met by residents of the Lake District before nationalization and grid lines were kept outside the district by agreement with the old Central Electricity Board. Now high taxation and the increased cost of living have left little in the private pockets for this kind of protective activity. It was hoped that with nationalization such costs would be a national charge, but the need for economy means overhead lines or nothing. Truly the Electricity Boards are placed in a dilemma; rural development, even with overhead lines, is not very remunerative and they hesitate to place extra burdens on other consumers.

* * *

An incident at the Sussex County Agricultural Show last week indicates the sort of ignorance over electrical matters with which agricultural electrical engineers have to contend in their dealings with farmers. In the grain drying exhibit on the South Eastern Electricity Board's stand a series of boards appropriately indicated the sequence of operations thus: Phase 1, pneumatic conveyor; phase 2, damp grain to cleaner; and so on up to phase 7. After studying these boards with considerable interest, a farmer appeared somewhat perturbed and eventually asked an official "whether this meant that he would have to have a 7 phase supply."

* * *

A single television receiver represents a small load, and an off-peak one, but collectively televiewers contribute an appreciable amount to the Electricity Boards' coffers. But it is only on such occasions as when the television service is extended beyond the normal hours that its effect can be judged. On the night of 30th–31st May the programme ran until 12.45 a.m. and the B.E.A. London Division reports that the load between midnight and 1 a.m. was 150 MW above normal. Some of this is attributable to lighting, of course.

* * *

It is stated by the *Western Morning News* that the Plymouth representative on the South Western Electricity Consultative Council "is perturbed by what he claims to be a fact that some people served by electricity burn candles instead because they cannot afford to use the power available." Electricity would have to be much dearer or candles much cheaper before this became worth while, I think.

* * *

Unwittingly I have helped to spread a "false report" about grocers by quoting a note from the *Manchester Guardian* on the lighting of food so as to give it a better appearance—or at least to avoid making it look inedible. The note was intended to be humorous but this was one of the "reports" about which Stockport grocers "complained indignantly at their monthly meeting" (*Grocers' Review*). If, even at second hand, I have maligned the grocers I am sorry—one shouldn't be funny about grocers.

Relaxation Methods

2. *Application to Electric Field Problems*

By H. McKIBBIN, M.Sc., and J. WEBB, Hons.B.Sc.

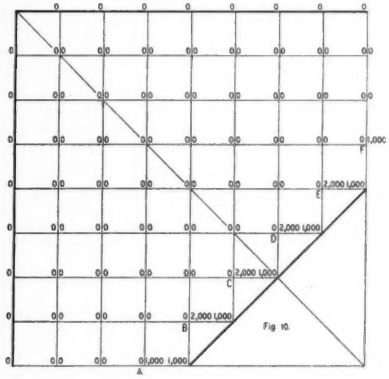
RELAXATION solutions are unlike those obtained by orthodox methods in that they are particular solutions. To make each solution as useful as possible it is usual to express all dimensions as ratios of a key dimension. For instance, in the example cited in the first article (*Electrical Review*, 10th July) the ratio of sheath side to conductor side is $2\sqrt{2}$ to 1, the key dimension here being the length of the conductor side. The solution obtained by using this ratio is applicable to all similar conductor arrangements, provided that the stated ratio is maintained.

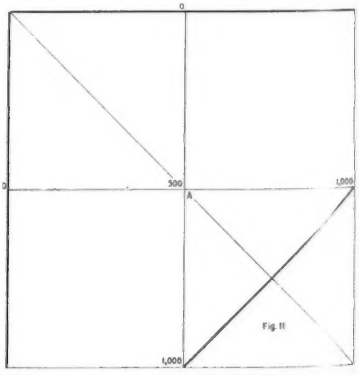
After expressing all the dimensions in terms of the key dimension, the next step is to decide on the mesh length, which can be quite important when a Poisson equation is involved, whereas when a Laplace equation is involved the mesh length as such is not of great importance since it does not appear in the final form of the finite difference approximation, viz., $F_0 \equiv \sum_{n=1}^{n=4} V_n - 4V_0$. However, the mesh length does influence the accuracy of the solution, as may be demonstrated by considering the terms which were neglected in the finite difference approximation. The neglected terms were:

$$\frac{2h^4}{4!}\left(\frac{\partial^4 V_0}{\partial x^4} + \frac{\partial^4 V_0}{\partial y^4}\right) + \text{higher powers.}$$

Since the mesh length is a fraction of the key dimension $h^4 > h^6 > h^8$, etc., it can as an approximation be said that the error involved in any solution is proportional to the fourth power of the mesh length. Thus if a solution is obtained by using a certain mesh length and then a second is obtained by using a net whose mesh length is one-half of the initial value, the error in the second solution will be roughly one-sixteenth of the error in the initial solution. For this reason, advancing from coarser to finer nets is an obvious method for increasing accuracy.

Fig. 10 shows a mesh of suitable fineness applied to one-quarter of the domain, the initial value of the potential at each node being shown as zero. This, as an initial guess, must obviously be wrong as can be seen from the values of the residuals at the





nodes A, B, C, D, etc., around the conductor (Fig. 10).

Before proceeding further, one point must be appreciated; it is that the relaxation process is such that no matter what values of potential are initially placed at the nodes in the domain between the fixed value boundaries, the final solution is inevitable. However, if an intelligent guess is made, so that the values placed at the nodes are close to the true value, then the effort involved in obtaining the final solution will be considerably reduced, because of the lesser values of the initial residuals.

A method of obtaining better initial values will now be shown. First consider the domain (Fig. 11) covered by a net whose mesh length is four times that of the final net in Fig. 10. Applying the finite difference approximation to node A yields:

$$\sum_{n=1}^{n=4} V_n - 4\,V_A$$

$$= 1{,}000 + 0 + 1{,}000 + 0 - 4V_A \approx 0,$$

giving $V_A = 500$.

By referring to Fig. 12 and using the value of V_A we can estimate values on a net whose mesh length is twice that of the final net (one-half the mesh length of the net in Fig. 11).

Since the operator ∇^2 is independent of the chosen axes, it is possible to make use of a 45 degree pattern as follows:

At node B (Fig. 12 inset)

$$F_B\ 45\ \text{deg} = 0 + 0 + 500 + 1{,}000 - 4\,V_B$$

$$V_B = 375$$

Because of symmetry about the diagonals of the sheath $V_B{}^1 = 375$ also.

Similarly $V_C = \frac{1}{4}(0 + 0 + 0 + 500) = 125$.

By using these values and the finite difference approximation in the ordinary way, values can now be estimated at the nodes D, E, F, D^1, E^1, F^1 in Fig. 13. For example, consider node D:

$F_D = 375 + 0 + 125 + 500 - 4V_D \approx 0$, giving $V_D = V_D{}^1 = 250$; also:

$V_E = V_E{}^1 = \frac{1}{4}(375 + 0 + 375 + 1{,}000) = 437.5$ (say 438).

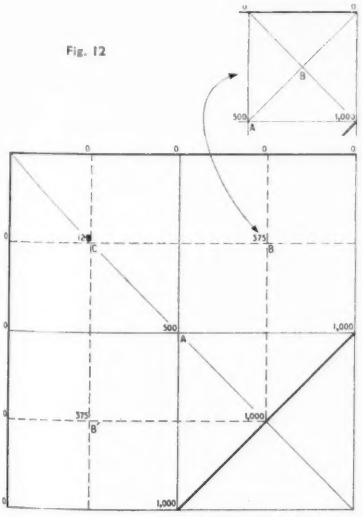
Note that the values of potential distribution are symmetrical about the centre-line; therefore 375 appears twice:

$V_F = V_F{}^1 = \frac{1}{4}(1{,}000 + 375 + 500 + 1{,}000) = 719$.

At this stage it would be possible and perhaps advantageous to relax on this coarse mesh, using these estimated values. In order that the reader may use this as an exercise the initial residuals are shown in Fig. 13.

If instead of relaxing at this point, the values in Fig. 13 are used to estimate

Fig. 12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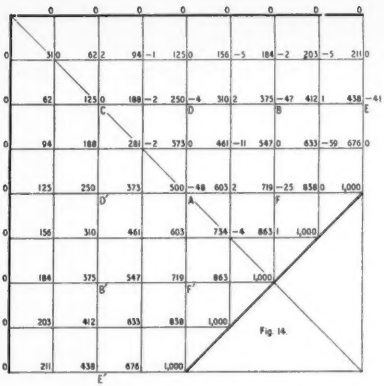
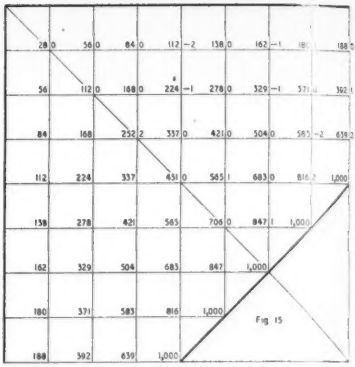




the potential distribution on the final net, the values shown in Fig. 14 will result. It is evident from the Fig. 15 final relaxation solution that a considerable saving of computation results from this approach.

Contour Plotting

One of the most attractive features of a relaxation solution from the engineer's standpoint is that a pictorial concept of the potential distribution can readily be obtained by drawing in "contours." In the present case contours will represent equipotentials. To plot any potential contour, say for V = 500, it is only necessary to interpolate along each line of nodes and obtain the positions at which the value of potential is 500. The "500" contour is then obtained by drawing a smooth curve through these points.

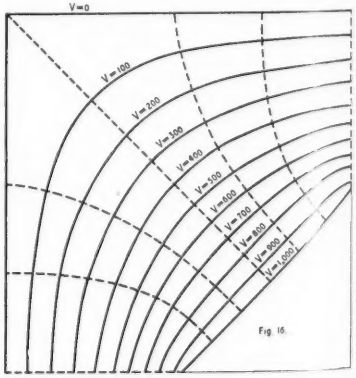
Linear interpolation yields quick results and, if accuracy is not of prime importance, will be adequate. Increased accuracy will be obtained using either graphical interpolation or an interpolation formula such as Newton's.[5] The graphical solution has one great advantage, namely, when the necessary interpolation graphs have been plotted it is only a matter of a few moments to plot a contour for any desired potential.

Fig. 16 shows the contours for the solution obtained in Fig. 15, drawn at intervals of 100 units.

The electric field, if required, can be obtained by plotting the orthogonal trajectories to these equipotentials. The field is indicated on Fig. 16 in broken lines. The equipotential lines are, however, more fundamental and allow of calculations of the stressing and capacitance to be made.

It can be shown (ref. 4 in article 1) that the capacitance the conductor arrangement treated earlier is numerically equal to $\frac{1}{4\pi}\oint\frac{\partial V}{\partial n}\,ds$ (e.s.u. or statfarads/cm length) if unit potential difference exists between the conductor and the sheath, the dielectric being air. Since the potential distribution in the case under consideration is inexpressible as an exact analytic function, it is necessary to replace the contour integral by a finite difference approximation, viz. $\Sigma\frac{\Delta V}{\Delta n}\Delta s$.

Fig. 17 shows an integration contour running parallel to a line of meshes. If the part RS of the contour joining the midpoints R and S of adjacent squares is considered, we may write $\Delta s = RS$ while



[5] "Calculus of Observations," by Whittaker P. Robinson (Blackie & Son).

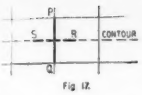


Fig 17.

$\Delta n = PQ$ and $\Delta V = V_Q - V_P$.

Consequently: $\frac{\Delta V}{\Delta n} \Delta s = \frac{V_Q - V_P}{PQ}$. $RS = V_Q - V_P$ so that for a square mesh:

$$\Sigma \frac{\Delta V}{\Delta n} \Delta s = \Sigma (V_Q - V_P)$$

This applies equally well to a contour following the diagonals.

Applying the above formula to contour A we have:

$$\Sigma (V_Q - V_P) = \Big[4 (639 - 392) + 8 (583 - 371 + 504 - 329 + 421 - 278 + 337 - 224 + 252 - 168)\Big] = 6,804.$$

Therefore $C = \frac{1}{4\pi} \times \frac{6,804}{1,000} = 0.542$ e.s.u./cm.

(Note Fig. 18 is only one quarter of the whole domain).

When the dielectric constant is K the capacitance per centimetre length will be K times the above figure.

To obtain a good estimation for the capacitance it is advisable to use the average of a number of integrations.

It has been pointed out previously that if only point relaxation were used the liquidation process would be extremely tedious. By operating simultaneously on a number of points (i.e. by using "block relaxation") a considerable speeding up of the process can be achieved.

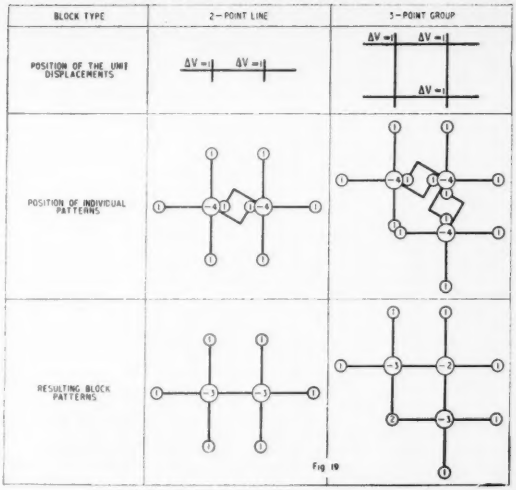


Fig 19

The construction of blocks is illustrated in Fig. 19 and their application will be apparent when a working knowledge of point relaxation has been gained.

It was mentioned previously that greater accuracy can always be obtained by advancing to finer nets. This is not always convenient, for example, when interest is focused on a small fraction of the domain. It is here that a graded net is of use; it consists of applying a fine mesh over the area in which increased accuracy is required while still maintaining the coarse mesh over the remainder of the domain.

In conclusion it must be emphasized that these articles have been of a simple nature, the aim being to introduce the methods rather than to explore their refinements and extensions.

Where it is possible to draw the boundaries and to fix potential values on them, relaxation methods will always yield a solution. The engineer who has mastered the technique will be able to obtain solutions for problems which would otherwise, even with a knowledge of more advanced orthodox mathematics, often prove intractable. The writers are indebted to Professor P. L. Burns, M.Sc., head of the Electrical Engineering and Physics Department, College of Technology, Belfast, for permission to use a number of diagrams contained in these articles.

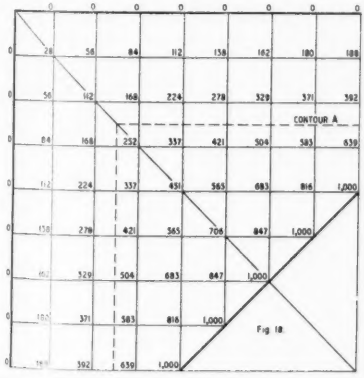


Fig 18

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Rural Electrification

THERE is so much good sense in the letter from Mr. Purse in your issue of 10th July referring to my paper on "Electricity and Food Production" that I would not like him to feel that there is any real dispute between us. He will see that I have dealt with his point in paragraph 30 of my paper when I explained that a revenue of at least 30 per cent of the capital cost is necessary if a rural scheme, considered in isolation, is to be self-supporting. For most Boards the figure is nearer 35 per cent.

There are, however, many factors to take into account, including diversity and the strong probability that the original revenue estimates will be exceeded at an early date as the benefit and economy of electricity become apparent to the rural consumers. It was for this reason that I said "Given a reasonable balance of rural and urban development and a fair proportion of industrial load, a Board should be able to regard a substantial programme of rural development having an initial return of 20 per cent as a fair commercial risk."

Bristol. S. F. STEWARD,
Chairman,
South Western Electricity Board.

Rationalized System of Lighting Units

MAY I draw your attention to the anomalous situation which exists in the definition and use of lighting units, a situation which in my view can only lead to confusion if allowed to continue. The Council of the Institution of Electrical Engineers has recently resolved, in support of the International Electrotechnical Commission, to encourage the adoption of the rationalized M.K.S. system of units for electrical purposes. That is a clear indication of the strength of opinion among electrical engineers on this matter and it is therefore particularly desirable in the closely allied field of illuminating engineering that a similar procedure should, if possible, be adopted.

There are two questions at issue: (i) the use of the M.K.S. units, and (ii) the rationalization of the units. The first of these, whilst clearly desirable, may not be entirely practicable at this stage. The significant change is from feet (or inches) to metres, so that the appropriate unit of illumination would be the "lux" expressed in lumens per square metre. The second point, and to my mind the really important one, requires that the unit of luminous flux, that is the lumen, be defined as the total flux emitted by a uniform source giving a luminous intensity in all directions of one candle (or candela). This alters the value of the lumen, or whatever the new unit is called, by the factor 4π, and makes it conform with the corresponding rationalized units of electric and magnetic flux. In that case we have unit flux per unit electric charge, or per unit pole, as required.

As one of those who have to teach the principles of electric lighting to engineering students, I find the present position most unfortunate. In all electrical calculations we invariably employ rationalized units, but when dealing with problems of illumination we have to make special explanations of the very obvious inconsistency that confronts us. With the development and application of ultra-high-frequency techniques, microwaves and light are now full partners in the upper part of the electromagnetic spectrum. It seems to me, therefore, that we are heading for serious difficulties if the basic definition of lighting units is not brought into line with the corresponding electrical units.

*London, W.C.*1. H. M. BARLOW,
University College, London.

Lamps for Street Lighting

MR. PULVERMACHER, in his article "Lamps for Street Lighting" (*Electrical Review*, 10th July, page 72) is to be commended for his courage. I agree wholeheartedly with his thesis that, where a particular light source can be shown to be clearly the best, its widespread

adoption should be encouraged. Of course, Mr. Pulvermacher is well aware that such an ideal solution ignores the present individualistic approach to street lighting which extends from the Ministry of Transport downwards.

Apart from this, however, I must take issue with him on his summary rejection of fluorescent lighting as a contender for the honour. He states that, *despite the great advantage fluorescent lighting has over the earlier discharge types*, the capital cost associated with it places it beyond normal economic consideration. In other words, his thesis is that, though neither sodium nor mercury lighting is the best illuminant for the purpose, we should commit ourselves for some twenty-five years to come to one of them. Surely before this Rubicon is crossed we should examine the matter more closely.

My own impression, supported by several of my colleagues who have some years of experience with fluorescent street lighting, is that a 3/80 W fluorescent lantern gives a road visibility comparable with a 400 W mercury or a 140 W sodium lantern and that its annual cost, allowing for normal rates of capital repayment and interest, is closely comparable with either. This is the case now, when the price of fluorescent lanterns is inflated by very small scale production. There is a large margin for cost reduction both in fluorescent lanterns and lamps, since the demand for both is an expanding one. There is a large margin, also, for still further improvement in fluorescent lamp efficiency. The general demand for mercury and sodium lamps, on the other hand, is unlikely to expand; they are "specials" and will remain so. The high efficiency of mercury and sodium lamps is inherent in their spectral characteristics and no increase in efficiency can be looked for in that direction.

There is a strong case for the widespread adoption of fluorescent street lighting now, even with all the odds against it. When, in addition, it is borne in mind that street lighting is paid for *in full* by ratepayers it becomes still more difficult to justify a decision which would ignore completely their views on acceptability, offer them second best at the cost of the best, and saddle them for twenty-five years with lighting equipment which is in danger of being outmoded even to-day.

Highgate, N.6. W. ROBINSON.

"CABMA Register"

British Products and Canadian Distributors

PUBLISHED for the Canadian Association of British Manufacturers and Agencies, managers of British Trade Centres in Toronto, Vancouver and Montreal, the "CABMA Register 1953 of British Products and Canadian Distributors" provides for the first time a really comprehensive volume containing accurate reference to British suppliers and their products. Its 800 pages include an extensive Buyers' Guide of over 3,750 British manufactured products with more than 1,300 cross references. Over 4,500 British manufacturers and 2,750 Canadian distributors are listed.

This officially sponsored directory will be the buyer's and importer's standard work of reference, in daily use by everyone requiring authoritative information about British goods available to the Canadian market. The volume (9½in by 7½in) is strongly bound and is divided for easy reference by index guide cards with reinforced tabs. It is published jointly by Kelly's Directories, Ltd., 186, Strand, London, W.C.2, and Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1, price 42s (by post 44s).

The first section, the Buyers' Guide, is an alphabetical list of British products for Canada, with the names of the British and Canadian suppliers classified under the product headings. An alphabetical Directory of British Manufacturers and Distributors will be found in a separate section, where the British firms are first listed with full details, including their distribution arrangements in Canada, and a similar list of Canadian suppliers follows. Two further sections enable the products and their sources of supply to be identified from their proprietary names and trade marks, respectively, and in order to ensure that the Register can be readily used throughout Canada, there is a complete French–English glossary of the product headings used in the Buyers' Guide.

The book contains goodwill messages from the President of the Board of Trade (Mr. Peter Thorneycroft, P.C.), the chairman of the Dollar-Sterling Trade Council (Mr. James S. Duncan, C.M.G.), the chairman of the Dollar Exports Council (Sir William Rootes, K.B.E.) and the president of the Canadian Association

of British Manufacturers and Agencies (Mr. Lewis J-B. Forbes). Mr. Duncan says in his message: "The publication of this comprehensive Register of British firms, their products and their Canadian representatives is a constructive step toward the expansion of British Trade in Canada."

In the preparation of the Register full co-operation has been received from the following organizations: the Dollar-Sterling Trade Council in Canada and, in the United Kingdom, the Dollar Exports Council, Federation of British Industries, Association of British Chambers of Commerce, National Union of Manufacturers, Scottish Council (Development and Industry), and the Northern Ireland Industries Council.

Health Centre Heating Installation

THE new Sighthill Health Centre, Edinburgh, has been equipped with a combination of "Panelec" electrically heated embedded floor and wall panels. The total connected load of 262 kW was distributed, 232 kW in the floors and 30 kW in the walls, the whole system being arranged for off-peak operation.

B.I.C.C. insulated lead sheathed heating cables are drawn into "Panelec" aluminium cable housing sections which are designed to ensure maximum transfer of heat from the cable to the surrounding concrete and other building materials. These are fitted, by means of specially formed securing clamps, to expanded metal covering the entire area of the floor. This serves the dual purpose of a heat diffuser and a key to the concrete or plaster as the case may be.

Access troughs to all floor panels are fitted with removable dished trench covers arranged to accommodate the various floor finishes used.

A section of the "Panelec" floor heating system under construction

Similar removable covers arranged for plaster are fitted to the concealed wall panels, thereby giving access to all connections, should it be necessary, without disturbing adjacent building work or decorations. The whole system is under fully automatic thermostatic control and is fitted with a time switch to limit electricity consumption to off-peak hours.

The heating system maintains internal comfort effect equivalent to 63–65 deg F in most rooms and public spaces and provides facilities to secure comfort effect equivalent to 70 deg F in certain rooms used for consultations or therapy. As the heating system is embedded in the fabric of the building, all floor and wall spaces have been left unencumbered and in consequence entirely free from dust traps. In addition, the reduction in the velocity of air currents, which is a characteristic of low temperature radiant warming, results in a lessened risk of infection by airborne germs and makes the system particularly suitable for buildings of this type. The Health Centre also makes a further valuable contribution to improving public health by avoiding the pollution of the atmosphere which is usual with alternative systems using solid fuel or oil.

Wood Poles for Overhead Lines

THE most suitable types of wood pole for overhead power and telecommunication lines are specified in B.S. 1990, published by the British Standards Institution (price 2s 6d). The sizes specified in this Standard, which supersedes B.S. 139, "Red fir wood poles for telegraph and telephone lines," and B.S. 513, "European larch poles for transmission lines," range from 18ft extra light poles to 85ft stout poles. The Standard emphasizes the importance of good preservation, essential to give the poles the maximum possible life, which can be achieved by pressure creosoting after the timber has been seasoned and all fabrication completed. In this connection an appendix describes the method of determining moisture content. As regards the mechanical strength of poles, another appendix shows the method of determining the crippling loads of stayed and unstayed poles.

COMMERCE and INDUSTRY

Copper Control to End

Electricity Workers' Wage Increase

THE Minister of Supply has made the Copper, Lead and Zinc Distribution (Revocation) Order, 1953 (S.I. 1953 No. 1082), which comes into operation on 5th August, revoking the Copper, Lead and Zinc Distribution Orders. The effect of this Order is that when the London Metal Exchange resumes dealings in copper next month licences will no longer be required for the purchase of any form of copper.

Import arrangements have been announced by the Board of Trade in Notice to Importers No. 575, dated 15th July.

Higher Retail Sales

Returns made by retailers reporting sales to the Board of Trade show an increase of nearly 10 per cent in May in the total value of sales of non-food goods. Explaining this, the *Board of Trade Journal* says that, as might be expected, the most outstanding results were in the household goods group, where the combined effect of price reductions due to purchase tax changes and of the abnormal pre-Coronation demand for television sets produced a rise of nearly 20 per cent. In the case of radio and electrical goods there was actually a jump of 72 per cent.

Cables for Zanzibar Scheme

The contract for the completion of the new 11 kV a.c. distribution scheme in Zanzibar, East Africa, is being carried out by the English Electric Co., Ltd., with Enfield Cables, Ltd., as sub-contractors. Enfield Cables are supplying and laying the underground cables and overhead lines for the scheme, including the concrete poles and equipment. Specially protected against the effects of alkaline soil and attack by white ants, the 11 kV and 660 V underground cables are paper insulated, lead sheathed and double wire armoured. Aluminium conductors are being supplied for the overhead lines; their erection, with the laying of underground cable, is under the supervision of Enfield Cables (East Africa), Ltd. The total value of the material and work to be carried out by Enfield is £65,000. Large quantities of p.v.c. sheathed and insulated wires have also been delivered by Enfield for the wiring of many houses on the island.

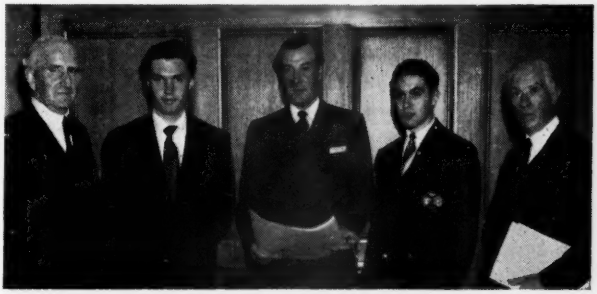
Shunting Locomotives for Steelworks

A new order for ten diesel-electric locomotives has been placed with Brush Bagnall Traction, Ltd., by the Steel Company of Wales covering seven 300 h.p. 0–4–0 and three 515 h.p. BO–BO types. This brings the total number of locomotives ordered by the Steel Company from Brush Bagnall Traction, Ltd., to seventeen.

Contractors' Apprenticeship Awards

In 1950 the Ministry of Public Works set up an Apprenticeship and Training Council to administer an apprenticeship scheme agreed between the N.F.E.A. and the Electrical Trades Union. Under the scheme apprentices are awarded scholarships, tenable for three years, for degree courses at a university or for higher national diploma courses at a technical college, covering fees, examination expenses and maintenance allowances. The first two scholarships given by the Council have been awarded this year, and at the London County Hall on Wednesday last week, Sir David Eccles, the Minister of Works, presented the certificates of award to the winners, David Arthur Cole (Dagenham), employed by J. G. Sneath, Ltd., and Brian Horace Walter (Maidstone), in the employ of G. F. Wallis & Sons (Electrical), Ltd.

Sir George Gater, Mr. D. A. Cole, Sir David Eccles, Mr. B. H. Walter, and Mr. J. C. Cox (secretary, A.T.C.E.I.) at the presentation of the first scholarships of the Apprenticeship and Training Council



Sir George Gater, chairman of the Council, presided and reviewed its work since its formation. He said that its establishment and smooth working were due to the co-operation from both sides of the industry. Sir David, in making the presentations paid tribute to the craftsmanship which had contributed so much to the Coronation celebrations, and he referred to the importance of training schemes in providing young men who would maintain that quality in the future.

Mr. L. C. Penwill, director and secretary of the E.C.A. and Allied Associations, in proposing a vote of thanks to the Minister, spoke of the importance of electrical installation work being carried out by qualified contractors. Mr. W. C. Stevens, general secretary of the E.T.U., seconded the proposal.

Hong Kong Illuminations

One of the most effective Coronation illumination displays in Hong Kong was a 26ft high banner consisting of two "ladders," each of 104 red, white and blue 5ft 80 W "Atlas Coronation" tubes surmounted by a flaming torch and with a crown and royal cipher superimposed, which dominated the Kowloon Ferry Concourse. This display, designed by Mr. H. Grice and Mr. Mackenzie, of the Hong Kong Government Architectural and Electrical Departments, presented electrical problems which were effectively solved by the Jardine Engineering Co., agents for "Atlas" lamps and fluorescent tubes in Hong Kong.

The chief difficulty was to support the banners from the crossbar with only a single central column and yet to conceal the connecting cables which, for a normal circuit, would number 416 in each "ladder." The problem was solved by using "Atlas" M.S. tubes with an external metal strip connected, for this application, at one end to one of the cathode terminals. The remaining cathode terminal was connected to a fine piano wire held in tension between the ends of the crossbar and the base, serving the double purpose of steadying, without appearing to support, the outer ends of the tubes and also acting as the neutral lead. At the inner ends of the tube, adjacent to the standard, a starter-switch was connected between the metal strip and one terminal, leaving only one cable per tube to be accommodated within the standard as feeds from the chokes housed in the base. The display was illuminated continuously for over a week without trouble, despite high winds and tropical downpours. The crown and cipher were decorated with coloured pigmy lamps. The fountain in the foreground was illuminated by nine sets of "Atlas" red, blue, green and gold fluorescent tubes on special quick-start flasher circuits.

Coronation illuminations at the Kowloon Ferry Concourse

Other installations carried out by the Jardine Engineering Co. with "Atlas" lighting equipment manufactured in Great Britain by Thorn Electrical Industries, Ltd., included one employing 5,600 decorative lamps at the Hongkong and Shanghai Bank building and another with 2,400 coloured lamps at the Jardine Matheson offices.

"Wireless & Electrical Trader"

From 19th September next the *Wireless & Electrical Trader* is to be published weekly instead of fortnightly. The change is being made to enable the journal to supply a more continuous news service at a time when many new developments are envisaged in both sound and television broadcasting. Founded in 1923 as a monthly, "The Trader" grew up with the rapidly expanding radio industry, and in 1925 weekly publication was instituted, but in 1941 the paper position forced it to become a fortnightly. The journal will continue to publish its well-known radio and television service supplements.

Automatic Generating Sets

To meet the demand for fully-automatic stand-by generating sets, Mirrlees, Bickerton & Day, Ltd., has designed suitable control equipment for its J and K ranges of diesel engines. These sets automatically start up on mains failure and close down on resumption of mains supply, at the same time being fully protected from faults while running.

The J and K engines are built in both in-line and "vee" forms, naturally aspirated, pressure-charged and high-pressure-charged with air intercoolers. The J engines are built in sizes

from 3 to 16 cylinders, are suitable for speeds of up to 1,000 r.p.m. and cover a power range of from 165 to 2,500 b.h.p. The K engines are built with from 5 to 12 cylinders, are suitable for speeds up to 450 r.p.m., and have a power range of from 485 to 3,000 b.h.p.

Damages Award

At Leeds Assizes on 10th July damages amounting to £3,080, with costs, were awarded to Benjamin Pugh Steel (52), a former linesman, the defendants being the British Electricity Authority. On 29th July, 1951, Mr. Steel was sent to clean insulators on a tower mast at a substation at Rotherham and was getting into position when a ladder moved and he fell to the ground, suffering severe injuries. It was alleged that a charge-hand on the ground had failed to ensure that the ladder was secured, but the Judge held that it was plaintiff's duty to see that the ladder was safe and that he was one-third to blame for the accident.

Electricity Workers' Wages

The National Joint Industrial Council of the Electricity Supply Industry last week agreed that as from the next full pay period all schedule rates of pay of manual workers should be increased by 1½d an hour and that all grade rates of foremen contained in Schedule E of the national agreement should be increased by £15 a year.

Royal Show Luncheon

Sir Joseph Hallsworth, chairman of the North Western Electricity Board, told an audience representing northern farming and electricity supply interests at a luncheon during the Royal Show at Blackpool that connection of farms for the national good, rather than of premises in places of interest primarily for tourists, would be first priority when allocating extra capital recently granted for rural electrification. Among those present were the chairman of the East Midlands Electricity Board, Mr. C. R. King, and the chairman and deputy chairman of the Merseyside and North Wales Electricity Board, Mr. J. Eccles and Mr. J. Rankin. Warning his hearers not to expect any spectacular increase in the rate of connection in the North West, Sir Joseph said that the Board had already achieved a 35 per cent increase in farms connected since nationalization and 61·5 per cent of the farms in the Area were now connected. He stressed that farmers must be prepared to use electricity to the full in farm and farm buildings and so guarantee the Board the revenue to make the extensive capital outlay worth while.

Cooker Publicity

In our last issue we referred to the domestic development plans of the Eastern Electricity Board, whose campaign this year is particularly directed to electric cooking. The accompanying illustration shows one of the posters that are being displayed throughout the Board's Area.

Eastern Electricity Board poster drawing attention to the advantages of electric cooking

Garcke's Manual

The fiftieth edition of "Garcke's Manual of Electricity Supply," published by the Electrical Press, Ltd., 19–20, Noel Street, London, W.1, at £3 17s 6d carriage paid, records the latest available statistics of electricity supply in Great Britain and Ireland. The sectional arrangement of the data follows that of previous editions, and includes a general survey of electricity supply progress during the year, the constitution, divisional organization and generating stations of the British Electricity Authority, with details of station capacity and operating data, statistical and descriptive particulars of the Area Boards, a section covering electrical manufacturing and allied companies, and a directory of executive personnel.

I. C. Engine Research

At the annual general meeting of the British Internal Combustion Engine Research Association, Viscount Falmouth, Companion I.E.E., M.I.Mech.E., was re-elected president. Air Commodore F. R. Banks, C.B., O.B.E. (Principal Director of Engine Research and Development, Ministry of Supply), Dr. S. F. Dorey, C.B.E., M.I.C.E., M.I.Mech.E. (Chief Engineer Surveyor, Lloyd's Register of Shipping), and Lieut.-General Sir Frederick G. Wrisberg, K.B.E., C.B., were re-elected vice-presidents. Vice-Admiral (E) F. T. Mason, C.B. (Engineer-in-Chief of the Fleet), Major-General H. R. B.

Foote, V.C., C.B., D.S.O. (Director-General, Fighting Vehicles Division, Ministry of Supply), and Sir Harold Roxbee Cox, Ph.D., D.I.C., M.I.Mech.E. (Chief Scientist, Ministry of Fuel and Power), were also elected vice-presidents.

A luncheon was held at Claridge's to celebrate the tenth anniversary of the Association's inaugural meeting. Viscount Woolton was the guest of honour and proposed the toast of the Association. Viscount Falmouth, in responding, referred briefly to some of the activities of the Association. The toast of the guests was proposed by Mr. H. N. G. Allen, chairman of Council, and Sir Harold Roxbee Cox responded.

Israel Customs Tariff Changes

The *Board of Trade Journal* for 11th July contains a list of amendments to the Israel customs tariff, including a number of electrical items. In the case of domestic electrical appliances for cooking and baking, electric light bulbs of glass, gas filled or vacuum, electric refrigerators and parts, radio sets and parts, washing machines and parts, vacuum cleaners, electric food mixers, electric razors, electric pots and kettles and other electric boilers, and electrical apparatus not elsewhere specified, the new rate is 50 per cent ad valorem against, in most cases, rates of 15 or 20 per cent previously. The new rate for electric lamps and accessories is 60 per cent, and for watt-hour meters, parts of electric refrigerators imported by factories for production and assembly and second-hand refrigerators and parts imported for reconditioning, 35 per cent.

Equipment for U.S. Navy

Pye, Ltd., has received an order from the United States Navy Purchasing Office for naval radio-telephone equipment worth approximately $278,000. The equipment is to be delivered later this year.

Prize-winning Lorry

The accompanying illustration is of a lorry first entered by the English Electric Co., Ltd., for the Liverpool Lord Mayor's Coronation procession and later going to Bootle to take part in that town's Coronation year carnival. There it was awarded two first prizes: one for the best advertising tableau and the other for the best maintained vehicle in the show.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £150 0s 0d
COPPER, H.C. Electro	ton £252 0s 0d
Fire Refined 99·70 per cent ..	ton £251 0s 0d
Fire Refined 99·50 per cent ..	ton £250 0s 0d
COPPER Tubes	lb 2s 1½d
Sheet	ton £305 10s 0d
H.C. wire and strip	ton £281 10s 0d
LEAD, English	ton £91 15s 0d
Foreign	ton £93 0s 0d
MERCURY	flask £70 10s 0d
TIN	ton £585 0s 0d
ZINC, G.O.B. Foreign	ton £73 10s 0d
Electrolytic	ton £74 5s 0d
BRASS Tubes	lb 1s 11½d
Sheet	ton £241 15s 0d
Wire	lb 2s 6¼d
PHOSPHOR BRONZE	
Wire	lb 3s 9½d
RUBBER, No. 1 R.S.S. spot ..	lb 19½d 19¾d

Industrial Electronics

On page 127 of last week's issue the caption to the illustration of the low inertia motor erroneously stated that this machine was made by Londex, Ltd. The firm concerned is Electro-Methods, Ltd.

Very High Voltage Cable Testing

When we were at the inauguration ceremony of the 275 kV supergrid line at Staythorpe last week, described elsewhere in this issue, we had the opportunity to spend a few minutes viewing the 275 kV cable testing station which has been established near the Staythorpe power station and on the route of the 275 kV Staythorpe-West Melton line. Although it is at present in rather temporary form it may well become at least a semi-permanent installation. At this station, on certain conditions, cable manufacturers may use short lengths of suitably designed cable as actual parts of the transmission line under normal operating conditions, the British Electricity Authority supplying the necessary isolating gear for switching in or out the appropriate sections of the line and cable. One of the B.E.A. conditions is that each length of

English Electric prize-winning lorry

cable to be put into service should include a joint, and we saw such joints being made with meticulous care on various makes of cables.

Iron and Steel Board

On 13th July the Iron and Steel Board assumed its responsibilities under the Iron and Steel Act, 1953. Offices are being equipped at Norfolk House, St. James's Square (telephone Whi 6931), which is the Board's headquarters and where there is already a nucleus staff.

Domestic Deep Freeze Cabinets

The liability to purchase tax of deep freeze cabinets which are designed for deep-freezing foods or the storage of frozen foods and operate generally at a temperature between 0 deg F and minus 20 deg F, which is at least 32 deg F below the minimum of the domestic refrigerator, has been under review. The British Refrigeration Association has been informed that it has been decided for the future to regard as chargeable under Group 12 (a) (i) of the tax schedule all such deep freeze cabinets having a storage capacity not exceeding 12 cu ft and which have one or more doors in the side or front, or one or more lids, such doors or lids being hinged to the body of the cabinet itself. Commercial cabinets, commonly known as ice cream conservators, are fitted with " plug-type " or " flip-flap " lids covering the opening in the top surface of the cabinet, and are not regarded as chargeable with purchase tax.

London Transport Inquiry

The Committee of Inquiry into London Transport, whose appointment was announced by the Minister of Transport in the House of Commons on 8th July, invites interested organizations or persons to submit evidence to assist the Committee in its task. Those wishing to submit evidence are asked to send it, in writing in the first instance, as soon as possible to the secretary of the Committee, Mr. B. E. Bellamy, at the Ministry of Transport, Berkeley Square House, Berkeley Square, London, W.1.

Royal Highland Show

The new tool for laying continuous lengths of electric cable, steel tubing or alkathene piping without trench cutting or other work, to which we referred in our issue of 3rd July (page 42), was shown on the stand of James A. Cuthbertson, Ltd., and not among the display by the South East Scotland Electricity Board as implied.

Annual Holidays

Brook Motors, Ltd., are closing their offices and works for annual holidays from 8th to 15th August at Huddersfield, and from 22nd to 29th August at Barnsley.

The works of Contactum, Ltd., at Cricklewood, will be closed from Friday, 24th July, until Monday, 10th August.

The works of the Banner Electric Co., Ltd., at Hoddesdon, Herts, will be closed from Friday, 7th August, until Monday, 24th August.

The factories and offices of J. Day & Co. (Derby Works), Ltd., will be closed from 31st July until 10th August.

The works and offices of Electric Elements (Willenhall), Ltd., will be closed from 25th July to 10th August.

Trade Announcements

From 1st August the address of the Exeter branch office of **British Insulated Callender's Cables, Ltd.**, will be 40, Whipton Village Road, Whipton, Exeter (telephone : Exeter 67308).

E. L. Pitt & Co., Ltd., have moved to Coronation Works, Perry Barr, Birmingham, 20 (telephone : Birchfield 5081).

The **Plessey Co., Ltd.**, announces that arrangements have now been completed whereby Amplion (1932), Ltd., are appointed distributors to the wholesale and retail trade for the sale of Plessey radio and television components.

The **Martindale Electric Co., Ltd.**, has opened branch premises at 25, Elmbank Street, Glasgow, C.2 (telephone : Central 0049).

Thorn Electrical Industries, Ltd., has opened a trade counter at 39/45, St. Pancras Way, N.W.1.

Catalogues and Lists

Doran Instrument Co., Ltd., Stroud, Glos.—List 115 describing the company's portable d.c. potentiometer (E.4246).

James Gordon & Co., Ltd., Dalston Gardens, Stanmore, Middlesex.—Catalogue describing pressure reduction and desuperheating equipment in which are shown some recent developments (H.41).

Enfield Cables, Ltd., Brimsdown, Enfield, Middlesex.—Illustrated folder presenting " Ensynamel " synthetic enamelled wire (EN.114).

Sturtevant Engineering Co., Ltd., Southern House, Cannon Street, London, E.C.4.—60-page booklet describing the Sturtevant range of air conditioning products (2303).

B. & H. (Nottm.), Ltd., Poppum Street, Nottingham.—Illustrated catalogue of " Bermex " switch and fuse gear together with a twelve page supplement covering wiring accessories and " specials " (3561/3).

George H. Scholes & Co., Ltd., Wylex Works, Wythenshawe, Manchester.—Revised list giving latest prices of the "Wylex" range of switch fuse control units (W.881).

NEW BOOKS

Metal Industry Handbook & Directory, 1953. Pp. 456. Published for *Metal Industry* by the Louis Cassier Co., Ltd., Dorset House, Stamford Street, London, S.E.1.

This publication (now in its 42nd year) is a comprehensive reference book for all those interested in the non-ferrous metal industries. It contains up-to-date information on the properties of the newer, as well as the more familiar, metals; an extensive section devoted to summaries of British Standard, Aircraft Material and D.T.D. specifications; and a section on the chief metal finishing processes, and data regarding all the common rod, bar, sheet and strip products.

In the new edition, rearrangement of the textual matter, particularly that applying to British Standards, has made reference easier, and the inclusion of details of the newer metals has widened the scope.

A directory for buyers gives a very wide range of producers, stockists, and factors of all basic metal products, metalworking machinery and tools, and metal finishing equipment. The Handbook is available only with the weekly journal *Metal Industry* at a combined subscription of £3 5s.

The Induction Motor. By H. Vickers. Pp. 531; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 70s.

This authoritative work is a much enlarged edition of the original book which was published in 1924. It has now been brought up to date by the addition of new material, particularly in connection with single-phase motors, selsyns and three-phase commutator motors. A chapter has also been included to explain the effects of unbalanced conditions in induction motors, making use of the symmetrical component method.

The treatment is most comprehensive and includes chapters on braking, speed control, phase advancing, motor noise, double squirrel-cage rotors, induction regulators, phase convertors, etc., as well as the material which one would expect in a book on induction motors. The subject of motor windings is very well explained with the aid of diagrams, and in the chapters devoted to design detailed calculations are included relating to motors from a 3,750 b.h.p. three-phase slip-ring motor to a ¼ b.h.p. single-phase machine. The cross-field theory is explained and developed in explaining the actions in single-phase motors, which are now so widely used since the development of the capacitor types.

The treatment of the various aspects of induction motors is largely mathematical, which makes the book suitable for students, designers and engineers.—J.L.W.

Radio Designer's Handbook. Edited by F. Langford-Smith. Fourth edition. Pp. 1,474; figs. and index. Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 42s.

This is a comprehensive reference handbook for all who are interested in the design and application of radio receivers and audio amplifiers. It deals in detail with basic principles and the practical design of all types of modern radio receivers, audio amplifiers and record-reproducing equipment. This edition is more than four times the size of the previous one and is the work of 10 authors and 23 collaborating engineers, under the editorship of F. Langford-Smith. The enormous amount of data it contains has been made readily accessible by means of a fully-detailed list of contents and a very complete index. The book is a self-contained source of information but exhaustive bibliographies are also provided.

The main subjects are: valves and valve testing; general theory and components; audio frequencies; radio frequencies; power supplies; design of complete A-M and F-M receivers; and reference information.

Books Received

Welding Technology. By F. Koenings[illegible]erger. Second edition. Pp. 341; figs. and [illegible]ndex. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price [illegible]5s.

Electromagnetic Machines. By R. Lan[illegible]glois-Berthelot. Pp. 535; figs. 309; [illegible]ndex. Macdonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price [illegible]5s.

American Electrician's Handbook. [illegible]y T. Croft. Revised by C. C. Carr. Seventh edition. Pp. 1,773; figs. and index. McGraw-Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4. Price 80s [illegible] the United Kingdom.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Direct-on-Line Starter

THE latest direct-on-line starter (Type DOC 71) to be introduced by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, complies with B.S. 587 for "frequent duty" (40 starts/hr) and is suitable where the starting current does not exceed eight times full-load value. All the ratings allow 25 per cent sustained overload as defined in B.S. 168. It is for use with single-phase or polyphase non-reversing squirrel-cage induction motors up to 5 h.p., 200/550 V, 25/60 c/s and control is by integral "start-stop" push-buttons, provision being made for remote control.

A triple-pole contactor with auxiliary retaining switch is incorporated; silver-faced double-break contacts are used. The contactor opens under gravity, and provides inherent under-voltage protection. Thermal overload relays protect the motor under ordinary working conditions; for resetting, after tripping on overload, the "stop" button is pressed.

The starter is enclosed in a cast-aluminium box of attractive appearance and is normally arranged for wall mounting, but it can be arranged for flange mounting if so desired.

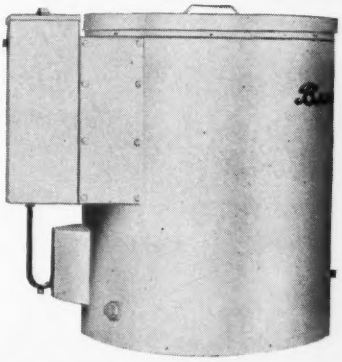
Electric Fires

Six new fires are being introduced for the 1953/54 season by REVO ELECTRIC CO., LTD., Tipton, Staffs. The "Dolphin," a robust cast iron fire vitreous enamelled in beige, can be supplied in 1 kW or 2 kW sizes. It is fitted with Revo "Challenge" (block type) fire bars, with a plated guard conforming to the latest safety requirements. The "Tubula" model (1 or 2 kW) has a chromium plated tubular frame with adjustable chromium plated reflector.

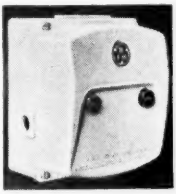
Specially designed for wall mounting, the "Reflexam" comprises a chromium plated reflector with cast brackets finished in "art shade" silver. It is supplied in 1 kW or 2 kW sizes, and the reflector can be adjusted by means of a special arm for cord attachment. The "Revo-inset" (1 or 2 kW) is designed specially for mounting into a wall panel or tiled fireplace. It is constructed of polished aluminium and is supplied with a slabbing frame for this purpose, being secured by four screws. Either block or pencil type elements can be fitted. The interior portion of the "Revo-outset" model is identical with the "Revo-inset" fire, but it is built into a sheet metal surround finished in bronze.

Agricultural Water Heater

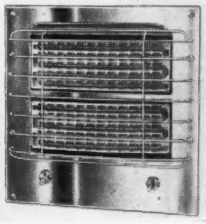
A water heater has been specially designed by BURCO, LTD., Rose Grove, Burnley, to provide 24 gallons of hot water twice daily for agricultural purposes. The special design of

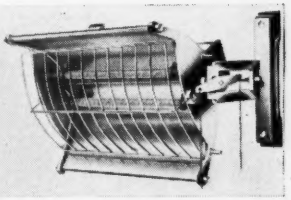


Burco agricultural water heater



B.T.H. direct-on-line contactor starter





"Revo-inset" and "Reflexam" fires

the heater and the position of the tap outlet allow the first 19 gal of hot water to be drawn off rapidly under gravity with no temperature drop. The remainder flows out more slowly, being dependent on the water flow feeding the auxiliary tank.

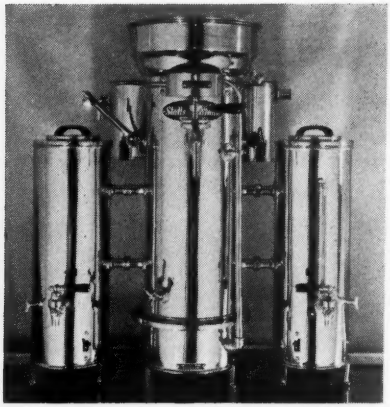
This arrangement thus provides abundant supplies of hot water for morning washing and yet allows ample time for replacement to meet evening requirements. The 1½ kW heating element is thermostatically controlled and heat losses during storage periods are reduced to the minimum by the fibre-glass insulation packed between the water container and the outer casing of the heater. After withdrawal of 24 gal, the reheating time to 140 deg F is approximately four hours, and to 180 deg F about six hours. For the maximum output of 24 gal twice a day the daily consumption is 14 kWh and 21 kWh respectively with thermostat settings of 140 deg F and 180 deg F.

Water Boilers and Café Sets

Fully automatic operation and an all-round increase in output and efficiency, with a considerable reduction in prices, are claimed for their new electric water boilers and café sets by JAMES STOTT & CO. (ENGINEERS), LTD., Oldham. Automatic control ensures that the boiler is always working to full capacity with the minimum consumption of electricity and, after switching on, the only operation to be performed is the movement of the draw-off tap.

There is no storage of boiling water. Instead, a large pre-heated reserve under thermostatic control is ready to supply large quantities of fresh boiling water immediately the draw-off is made. As soon as the draw-off tap is moved, a micro-switch brings the load full on and boiling water is delivered. When the tap is closed, the thermostat again takes charge. On the new café sets, the boilers are provided with fall-down swivelling feed arms to both urns, each operating a micro-switch in the same way as the main draw-off tap. The boilers have automatic cold water feed and are made in three sizes giving outputs of 35, 55 and 75 pints in 10 minutes.

Stott café boiler equipment



Instrument Soldering Iron

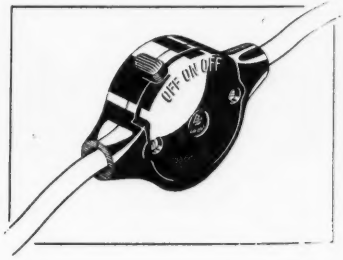
The latest addition to the range of "Solon" soldering irons made by W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 51–53, Hatton Garden, London, E.C.1, has been specially designed for soldering operations in the compact assemblies employed in the radio, television, electronic and instrument industries. It embodies many of the features of the company's other soldering irons, is light (3¼ oz) and easy to handle, and is only 9in long, the heating element being rated at 25 W 220/240 V. The iron is supplied complete with 6ft of three-core flexible cord and costs 19s 8d.

Henley "Solon" instrument soldering iron

Line Cord Switch

An addition to the company's range of "Geiger" switches is the on-off line cord switch now available from WALTER LOGAN & CO., LTD., 26, Downing Court, Brunswick Square, London, W.C.1. The construction is basically the same as their three-heat blanket switch with the exception that there are two off and one on positions. Thus the "off" positions can be readily found at either end as the centre position is "on." This dust-proof switch is of moulded "Bakelite," rated at 2 A and is available for a voltage range of 200–250 V. The retail price is 6s 0d or with earth connection 6s 9d.

"Geiger" line cord switch



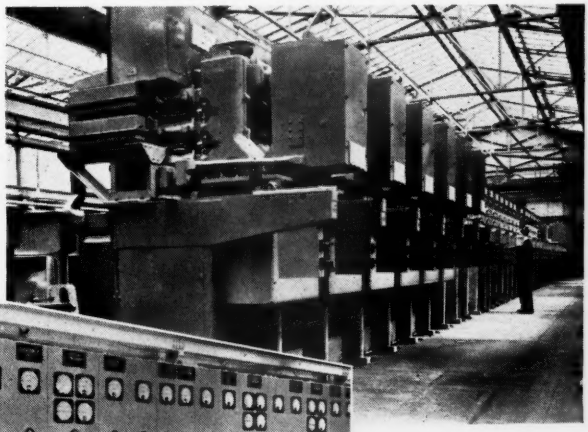
SWITCHGEAR FOR VENEZUELA

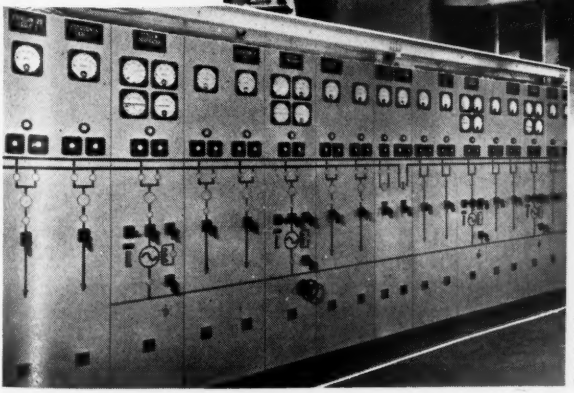
Record Delivery of Power Station Equipment at Cardon Refinery

COMPLETED by A. Reyrolle & Co., Ltd., in little more than six months, instead of the usual year and a half required for this type of equipment, the bulk of a large order for new switchgear has recently been shipped on m.s. *Adviser* to Cardon refinery, Venezuela. The rest of the switchgear and the control board is following on m.s. *Araby*.

The rapid growth of the refinery since its inauguration four years ago would have necessitated the eventual replacement of the existing 250 MVA switchgear by equipment of increased capacity, to cater for a planned increase in the present installed plant capacity of 30,000 kW. While this matter was under consideration a severe fire occurred in the power house on 30th September last which, destroying the existing switchgear upon which the operation of the electrically controlled refinery depended, caused a complete shut-down. Only the speedy installation of makeshift equipment from Shell's own resources, together with assistance from the oil industry locally, enabled operations to be resumed after three weeks instead of, as was at first feared, several months.

Since those provisions were perforce temporary, steps were taken to explore the earliest possible source of supply of new equipment both in the United States and the United Kingdom. Reyrolle offered to make an all-out effort to manufacture two-thirds of the metalclad switchgear in six months, the control and relay board in seven months, and the balance of the switchgear (comprising the third section of panels) in eight months. As this delivery time compared very favourably with that quoted by U.S. firms, the order was placed with Reyrolle, thereby rendering a large saving in dollar expenditure. The order, valued at about £116,000, was placed on 5th November for a 103ft long 28-panel metalclad switchboard (6·6 kV 60 c/s duplicate busbar) comprising type "B5T" gear with a rupturing capacity of 500 MVA at 6·6 kV. Associated with it is a 32-panel control board equipped with all the necessary control protective relays, recording





Above: **A general view of the 103ft 28-panel metalclad switchboard for Cardon oil refinery in course of construction**

Left: **The 32-panel control board for use with the switchboard is equipped with all necessary control protective relays, including recording and indicating instruments**

and indicating instruments, etc. Meanwhile, construction is under way at Cardon of a new switchhouse, which is to be equipped with fireproof doors (Mather & Platt, Ltd.) and carbon dioxide fire-extinguishing equipment (Pyrene Co., Ltd.).

Progress was such that 90 per cent of the complete metalclad gear was despatched for shipment by the m.s. *Adviser* at the end of June. Installation at Cardon will be carried out by the Shell staff, assisted by three engineers from Reyrolle's works at Hebburn, supervised by one of their senior supervising engineers, who will be sent from Canada.

Fire-Resistant Cables

New Range Introduced by Pirelli-General

A NEW range of asbestos-paper tape insulated cables has been developed by Pirelli-General Cable Works, Ltd., for use in circuits up to 660 V where fire resistance, non-inflammability, maintenance of electrical properties under elevated temperatures, and non-ageing properties are required; they are patented under British Patent No. 661540.

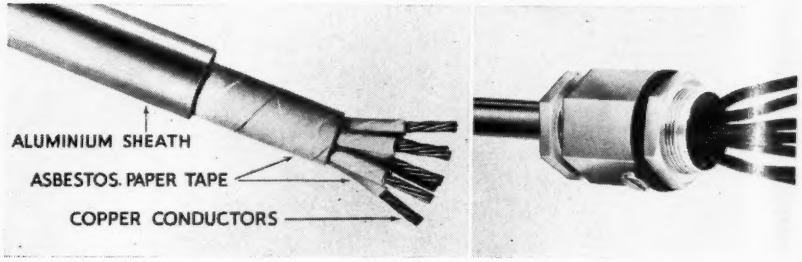
The cables comprise copper conductors, either single or stranded, which are lapped with a special quality asbestos-paper tape. The cores are laid up, asbestos-paper taped, and sheathed with a welded aluminium sheath (" Asbestal ") or, alternatively, with a welded stainless steel sheath (" Asbesteel "). The smaller " Asbestal " cables have a cold-welded aluminium sheath with a small longitudinal fin, while the larger ones have a corrugated argon-arc welded aluminium sheath, which has the advantage of flexibility similar to that of a lead sheathed cable, combined with sufficient stiffness in relation to weight to enable the distance between supports to be considerably greater than that necessary with lead sheathed cable. The corrugations also increase the resistance of the sheath to mechanical damage.

The multicore cables are designed to have a constant insulation thickness between conductors, with a variable thickness between conductors and sheath. The conductor insulation thickness varies very little from 0·05in but, owing to the limited number of sheath diameters, considerably more than 0·05in thickness between conductors and sheath is used in many cases. Single-core cables have all to be insulated to fit the nearest standard sheath and considerable variation above a 0·05in minimum consequently occurs. The asbestos-paper tape employed has a high degree of resistance to moisture absorption and to destruction by fire.

The insulant is indestructible and the cable itself will continue to function at temperatures up to the melting point of the sheath. Since the insulant is dry, the cables are non-bleeding, thus making them suitable for vertical runs which may be subject to overload or high temperatures.

" Asbestal " cables are available in most normal sizes between 1/·044 and 37/·103 (single-core), between 1/·044 and 19/·072 (two-core), between 1/·044 and 19/·064 (three-core), between 1/·044 and 19/·052 (four-core) and between 1/·044 and 19/·044 (seven-core). " Asbesteel " cables are available in most normal sizes between 7/·036 and 37/·083 (single-core), between 3/·029 and 19/·052 (two-core), between 3/·029 and 19/·052 (three-core), between 1/·044

Left: **Telescoped seven-core " Asbestal " heat and fire resisting cable.** *Right:* **Non-plumbing type terminating gland for " Asbestal " or " Asbesteel " cables**



and 19/·052 (four-core) and between 1/·044 and 7/·052 (seven-core). Telephone cables of multiple twin or quad construction are also being manufactured.

The corrosion resistance of "Asbestal" is similar to that of other types of aluminium sheathed cable and is in general not very different from that of lead covered cable. Where the cable is to be drawn through ducts, laid direct in the ground, or installed in corrosive atmospheres, suitable additional protective covering is recommended, the type normally supplied being compounded, p.v.c. double taped, compounded, lapped with two compounded glass staple tissue tapes, and compounded hessian taped overall.

"Asbesteel" cable has advantages where increased strength and resistance to mechanical damage are required. The stainless steel sheath has excellent corrosion resisting properties which render it particularly suitable for use in chemical and rayon factories. Where this cable has to be laid direct in the ground, the additional protective covering described above is also recommended.

The minimum bending radius in installation for both types of cable should be twelve times the overall diameter. These cables can be handled by normal methods during installation, although the cold-welded aluminium sheath type and the stainless steel sheath type are somewhat less flexible than a corresponding lead covered cable. A bending tool is available for use when required and is recommended where accurate setting is necessary. This minimum bending radius does not apply to corrugated aluminium sheathed cables.

The installation technique for both types of aluminium sheathed cables is generally similar to that for other aluminium sheathed cables. Non-plumbing type glands are available; they are threaded to suit standard conduit boxes and fittings and are provided with nuts for fitting to boxes with plain entries.

LIGHTING NOTES

STOURBRIDGE Highways Committee is planning a £62,000 scheme, spread over five years, for a complete change-over from gas to electric street lighting for the town's Class II, III, and district roads. About £23,330 is likely to be spent on converting Class I road lighting to electricity in the next three years.

STOKESLEY (Yorks) R.D.C. has asked the North Eastern Electricity Board to submit estimates for street lighting in the 13 parishes in the rural area.

The NEWCASTLE-ON-TYNE City Council has obtained sanction to a loan of £25,000 for street lighting on the Longbenton housing estate. The Watch Committee intends spending £1,796 on replacing gas lighting with electricity in Jesmond Dene Road and Matthew Bank. It is proposed to erect thirty-three standards each carrying 140 watt sodium lamps.

HARTLEPOOL Town Council is to spend £2,241 on the provision of 11 street lamps in Winterbottom Avenue and 59 on the West View estate.

Subject to Ministry approval, TYNEMOUTH Town Council proposes to install sodium lighting in Wallsend Road and Norham Terrace and improve the lighting of Queen Alexandra Road.

CANNOCK Urban District Council is to seek consent for the continuance of street lighting from Hednesford Road along the main road through Chadsmoor into Hednesford. The estimated cost is £5,000.

The Finance Committee of the WILLENHALL Urban District Council proposes to borrow £3,930 for street lighting in Moseley Road.

SOUTHPORT Lighting Committee is seeking loan sanction for a £6,784 improved street lighting scheme in Liverpool Road.

For the floodlighting of Lincoln Cathedral 61 floodlights having a total load of 57·5 kW have been installed by the Lincoln District Installation Department of the East Midlands Electricity Board to a plan prepared by the Edison Swan Electric Co., Ltd.

ELECTRICITY SUPPLY

300 *MW of New Plant Installed*

Agreement on St. Lawrence Project

AN unusually large amount of new plant was installed in B.E.A. power stations in June, including five generating sets with a total capacity of 300 MW and nine boilers aggregating 2,845,000 lb/hr. They were as follows:—Barking "B," 75 MW B.T.H. set; Bankside, 60 MW B.T.H. set and 375,000 lb/hr boiler; Brunswick Wharf, 52·5 MW Metropolitan-Vickers set and 320,000 lb/hr Clarke Chapman boiler; Brighton "B," 320,000 lb/hr Babcock & Wilcox boiler; Littlebrook "C," 360,000 lb/hr International Combustion boiler; Carmarthen Bay, 52·5 MW Metropolitan-Vickers set and 240,000 lb/hr B. & W. boiler; Thornhill, 200,000 lb/hr Mitchell boiler; Poole, 300,000 lb/hr I.C. boiler; Walsall, 180,000 lb/hr B. & W. boiler; and Keadby, 60 MW Parsons set and 550,000 lb/hr Stirling boiler. At stations controlled by the B.E.A. and the North of Scotland Hydro-Electric Board the net increase in installed capacity during the month was 244 MW.

The largest percentage increase in electricity generated in any month so far this year was recorded in June (12·1 per cent), for which the Coronation celebrations were no doubt partly responsible. In the first half of the year 33,155 million kWh was generated, an increase of 6·7 per cent, as shown in Table 1.

Details of kWh sold by the British Electricity Authority and taken by Area Boards for their consumers in June are given in Table 2 on the facing page. The national figures show an increase over June, 1952, of 11·5 per cent, but, when corrected for weather and the number of effective working days, the increase is 9·3 per cent. The weather conditions were slightly colder and there were more effective working days than in June, 1952.

Lake District Supply Costs

Addressing the Penrith Rural District Council recently Mr. J. E. Shepherd, sub-area manager, North Western Electricity Board, said that the average cost of connecting rural consumers in the Lake District National Park was £359. This was about ten times the cost of connecting an urban consumer. In the case of the supply to Martindale, near Ullswater, the actual cost per consumer was £469, while estimates for other valleys where the inhabitants were asking for electricity were as follows:—Borrowdale, £311 per consumer; Matterdale, £296; Langdale, £159; and Hartsop and Deepdale, £135.

The subject of supplies to Borrowdale and Langdale was further discussed at a meeting of the Lake District National Park Planning Board, in reply to whose request the Electricity Board had written stating that it would be a long time before the Board would be able to proceed with work in those areas. This gave rise to a protest that the Electricity Board was adopting "a definite policy of non-co-operation." Lt.-Col. R. Morton said that there were 20 farms, five hotels and 130 houses needing electricity in a small

TABLE 1—ELECTRICITY GENERATED AND CAPACITY OF PLANT INSTALLED

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total*		
British Electricity Authority ..	2,524	65	3·8	4,520	11	4,538	4,257	17,408
North of Scotland H.E.B. ..	20	1	1·2	32	51	88	86	558
Total for June, 1953	2,544	66	5·0	4,552	62	4,626	4,343	17,966
Corresponding total for June, 1952	2,320	61	4·8	4,058	59	4,127	3,877	16,553
Increase or decrease, per cent ..	+9·7	+8·2	+4·2	+12·2	+5·1	+12·1	+12·0	8·5
Total to date (6 months), 1953..	18,153	474	40·5	32,551	520	33,155	31,207	
Total for corresponding months of 1952	17,314	415	35·4	30,328	659	31,066	29,282	
Increase or decrease, per cent ..	+4·8	+14·2	+14·4	+7·3	−21·1	+6·7	+6·6	

* The total includes 7·5 million kWh generated by oil engines and 4·8 million by waste heat plants in June.

TABLE 2.—ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for June			Totals for Twelve Months Ended 30th June		
	1952 Mill. kWh	1953 Mill. kWh	Increase or Decrease %	1952 Mill. kWh	1953 Mill. kWh	Increase or Decrease %
London	323·9	364·0	+ 12·4	5,205·2	5,654·5	+ 8·6
South Eastern	194·1	223·4	+ 15·1	2,965·3	3,281·7	+ 9·6
Southern	234·6	264·8	+ 12·9	3,458·1	3,836·9	+ 10·9
South Western	113·1	127·5	+ 12·7	1,675·3	1,842·9	+ 10·0
Eastern	324·2	372·0	+ 14·7	4,856·3	5,333·9	+ 9·8
East Midlands*	290·6	327·6	+ 12·7	4,200·5	4,547·7	+ 8·3
Midlands*	400·8	424·8	+ 6·0	5,751·8	6,064·8	+ 5·4
South Wales*	253·7	274·6	+ 8·2	3,189·8	3,328·5	+ 4·3
Merseyside and N. Wales*	235·7	247·8	+ 5·1	3,416·4	3,373·8	− 1·4
Yorkshire*	393·1	444·6	+ 13·1	5,531·3	5,927·0	+ 7·2
North Eastern*	243·5	266·6	+ 9·5	3,503·2	3,545·9	+ 1·2
North Western*	422·5	478·3	+ 13·2	6,401·4	6,484·8	+ 1·3
South East Scotland	81·7	88·1	+ 7·8	1,190·8	1,257·5	+ 5·6
South West Scotland*	198·5	210·4	+ 6·0	2,880·0	3,045·4	+ 5·7
Total all Area Boards	3,710·0	4,111·5	+ 10·9	54,255·4	57,525·3	+ 6·0
Direct Supplies by Central Authority	51·5	82·6	+ 51·6	710·5	831·7	+ 17·1
Grand Total	3,761·5	4,197·1	+ 11·5	54,965·9	58,357·0	+ 6·2
Mainly Industrial Areas Marked*	2,438·4	2,674·7	+ 9·7	34,874·4	36,318·2	+ 4·1
Mainly Non-Industrial Areas	1,271·6	1,439·8	+ 13·2	19,381·0	21,207·1	+ 9·4
Total Number of Effective Working Days	26·89	27·29				

* Over half the total sales by the Boards in the preceding financial year were to industrial consumers.

area in Borrowdale. Three years ago the Electricity Board had submitted a route plan for the supply.

Transfer of Colliery Networks

Steady progress is being made in the transfer of electricity networks in colliery areas from the National Coal Board to the North Eastern Electricity Board. In the Wear area, the network in the Cornsay district has been transferred, while at East and Middle Herrington estimates for the change-over have been prepared and two new substations are being built. Reports have been submitted to the Coal Board for the transfer of the networks at Easington, Blackhill, Witton Gilbert, and South Hetton. In the Tyne area, the transfer of consumers at Ashington and Woodhorn is being considered.

Development in the North-East

At a meeting of the North Eastern Electricity Consultative Council it was reported that during March–May 75 new substations had been put into operation, 47 of which were to supply farms and villages. During the period 66 farms were connected and a supply was made available at a further twelve villages. Estimates amounting to £1,359,098 were approved for projects including supplies to 113 housing and 73 rural schemes. The Board has made arrangements for each service centre to display a list of names and addresses of registered contractors.

To make provision for future housing areas outside Middlesbrough, the Board is planning the construction of a larger 66 kV substation in Marton Road adjoining the existing substation, and the Town Council has agreed to lease the land required. The Board is to be asked to screen the substation with trees and shrubs.

Power from St. Lawrence River

The Canadian plan for producing electricity by the exploitation of the rapids of the international section of the St. Lawrence River has now been agreed to by the United States authorities. The United States Federal Power Commission has granted a licence to New York State to join with the Ontario Hydro-Electric Power Commission in installing 2,200,000 h.p. of generating plant, the output to be divided equally between the two authorities. The electrical scheme is part of a project for deepening the river where necessary to provide a seaway for large vessels between the Great Lakes and the Atlantic ports. The total cost is estimated at from $700 million to $1,000 million, 60 per cent being in respect of the electrical installations and associated civil engineering works. Meetings for co-ordinating the duties of the engineers of the two authorities will shortly be held. Mr. Saunders, chairman of the Ontario Commission, has expressed the hope that work will start before the end of this year, if not delayed by litigation in the U.S. regarding objections which have been lodged to the granting of the licence to New York State.

Financial Section

STOCKS and SHARES

DEALINGS were expected to begin on Tuesday in this week at 1½ premium, in the English Electric Co.'s new 4½ per cent debenture stock, issued publicly at 97½. As stated elsewhere, the offer was an overwhelming success, applications for some £50 million stock being received for the £2½ million available. Applications for all classes of the company's stocks were to receive an allotment. Others took their luck in a ballot for the remainder.

English Electric New Ordinary

Opening business in the English Electric Co.'s new ordinary shares took place at a premium of 3s 1½d on the price of 48s 6d at which they are offered by way of rights to existing stockholders, in the proportion of one new for three old. The latter were made ex rights to the issue and also ex the 5 per cent interim dividend. For the next few weeks the new shares will be transferable in allotment letter form, and therefore "free of stamp" to the buyer. On the basis of the company's anticipation that it will be possible to maintain the 15 per cent rate of dividend on the enlarged capital, the shares can be bought about 51s 6d, to give a prospective yield of £5 16s per cent.

A. E. I. Shares

The period has now ended during which the allotments of the "repatriated" Associated Electrical Industries ordinary shares could be renounced. They now rank on all fours with the old, including qualification for the interim dividend due in September. There was a rising demand for them in the closing stages, buyers being keen to acquire the shares while still available "free of stamp," and the last prices were above the figure of 75s at which the new were offered to existing stockholders. The single class of shares was subsequently quoted at 76s 3d. Firmness in the price was assisted by a market impression that little delay or difficulty is being experienced in finding permanent homes for the 70 per cent of the issue which the underwriters were called upon to take up.

Parmiter, Hope & Sugden

The 1s ordinary shares of this company, which has just declared the final dividend for the year to last March, are quoted around 2s 3d. The price has not varied by more than 3d either side of that figure for the past year or so. Distributions for the latest period total 25½ per cent, a fraction more than before, and mark the fourth increase in succession. Net profit of £38,000 is practically unchanged on the year, and covers about twice the distribution on the £143,000 ordinary capital. The yield on the shares works out at over 11 per cent.

Murex Results

In maintaining the dividend for the year ended last April at a total of 15 per cent, the Murex Company is carrying out the forecast made at the time of the issue of new ordinary shares in December. These shares participate in the final payment, so that the net amount distributed in dividends for the latest period goes up from £168,000 to £182,000. This is still well within net group earnings of £393,000, although that figure is some way below the previous surplus. In contrast with former years, losses have arisen this time on the turnover of stocks. Disregarding what the company describes as this fortuitous element, trading profits are stated to have decreased by 12½ per cent. The shares have since been on the dull side, at 56s showing a florin loss on the week.

Dividends Declared

Oldham & Son are bringing the ordinary dividend for the latest year to a total of 17½ per cent, which is equivalent to the 35 per cent rate paid last year on half the present capital of £400,000; a share-for-share bonus was distributed about this time last year. The 1s shares are quoted at 2s 6d to yield 7 per cent. Lodge Plugs 5s shares at 21s 6d show a return of a little over 8 per cent on the basis of the unchanged dividend of 35 per cent, of which the final has just been declared.

Six Per Cent

The investor requiring a reasonably safe 6 per cent on his money is able these days to take his choice from a wide range of popular ordinary shares in the industrial market. In the electrical equipment section, mention may be made of fairly substantial lines recently on offer of Henley's Telegraph 10s shares at 16s 7½d., which show a prospective yield of 6·3 per cent, and of Telephone Manufacturing 5s shares at 7s 9d, yielding a fraction more. Scottish Cables 4s shares at 12s 4½d xd give about 6½ per cent on the money. Siemens £1 ordinary and Allen West 5s shares at the offered prices of about 32s 9d and 11s 6d, pay respectively a little over 6 and 6½ per cent on the basis of the last dividends.

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 20th July 1953	Week's Rise or Fall	Est. Yield p.c. £ s d
Gilt-edged and Overseas Stocks					
Brit. Elec. 1968/73	3	3	87½	—	3 8 6
Brit. Elec. 1974/77	3	3	86½	—	3 9 4
Brit. Elec. 1976/79	3½	3½	92½	+½	3 15 8
Brit. Elec. 1974/79	4½	4½	102	—	4 3 4
Calcutta Elec. ..	6†	6†	19/6	—	6 3 0†
East African Power	7	7	23/6	+6d	5 19 3
Nigerian Elec. ..	10	10	22/6	—	8 13 0
Palestine Elec. "A"	5†	Nil	11/3	+9d	Nil
Perak Hydro-Elec.	Nil	Nil	15/-	—	Nil
Equipment and Manufacturing					
AberdareCables(5/-)	20	25	16/-	—	7 16 4
Aerialite (1/-) ..	83⅓	88⅓	8/9	—	10 1 10
Allen, W. H. ..	15	15	45/9xd	+6d	6 11 3
Aron Elec. Ord. ..	15	20	45/-xd	—	8 17 10
Assoc. Elec. Ord...	20	20	76/3	+½	5 5 0
Automatic Tel. & El.	15	15	56/3	—	5 6 8
Babcock & Wilcox	18	18	63/6	−3d	5 13 4
Baldwin, H. J. (2/-)	25	20	4/-	—	10 0 0
Bakelite (10/-) ..	—	12½	18/-	—	6 19 0
British Aluminium	12	12	38/-	+6d	6 6 3
B.I. Callender's ..	9	10	36/-	+1/-	5 11 0
British Thermostat (5/-)	30	35	16/3	—	—
British Vac. Cleaner (5/-)	25	25	11/6	—	10 17 6
Brook Motors (10/-)	20	20	32/6	—	6 3 1
Brush Ord. (5/-) ..	10	4	4/3	—	—
A. F. Bulgin (1/-)	30	30	2/9	—	10 18 0
Burco (5/-) ..	38⅓	35	18/3	+9d	9 13 0
Chloride El. Storage	15	20	75/-	+2/-	5 6 8
Cole, E. K. (5/-) ..	25	25*	17/9	+6d	7 0 10
Cossor, A. C. (5/-)..	Nil	10	9/-	+3d	5 11 1
Crabtree (10/-) ..	17½	17½	28/6	—	6 2 9
Crompton Parkinson Ord. (5/-) ..	11½	11½	11/3	—	5 0 0
De La Rue (5/-) ..	35	Nil	7/9	+9d	—
Decca (5/-) ..	112½	150	26/6	—	5 13 2*
Dewhurst (2/-) ..	22½	19*	5/6	—	6 18 3
Dictograph Tel.(2/-)	20	20	5/6	—	—
E.M.I. (10/-) ..	12	12	13/6	—	8 17 10
Electrical Components (5/-) ..	20	20	10/-	—	10 0 0
Elec. Construction	15	15	52/6xd	—	5 14 3
Enfield Cable Ord.	7½	5	20/6	—	4 17 6
English Electric ..	15	15	51/3xr	—	5 17 0
Ericsson Tel. (5/-)	22†	22*†	37/-	—	2 19 6†
Ever Ready (5/-)	35	35	25/6	—	6 17 9
Falk Stadelmann	15	15	42/9	—	7 0 2
G.E.C. Ord. ..	22½	22½	40/9	—	5 10 5*
General Cables (5/-)	30	30	16/3	—	9 4 8
Greenwood & Batley	15	17½	40/-	—	8 15 0
Hackbridge Cable (5/-)	20	20	11/6	—	8 13 10
Hackbridge Hewittic (5/-)	20	20	17/-	—	5 17 8
Hall Tel. Acc.(10/-)	10	10	10/-	—	10 0 0
Heatrae (2/-) ..	12½	12½	1/-	—	6 5 0
Henleys (10/-) ..	20	10½*	16/6	+3d	6 7 3
Holoplane (5/-) ..	15	20*	12/6	—	8 0 0
Hoover (5/-) ..	35	25	22/-	—	5 13 8

Company	Dividend Previous	Dividend Last	Middle Price 20th July 1953	Week's Rise or Fall	Est. Yield p.c. £ s d
Equipment and Manufacturing (continued)					
Intl. Combustion (5/-)	25	15*	13/9xd	—	5 9 0
Johnson & Phillips	15	15	50/6	—	5 19 0
Lancashire Dynamo	12½	12½*	41/3	—	6 1 0
Laurence, Scott(5/-)	15	15	12/3	—	6 2 6
London Elec. Wire	12½	15	57/-	+9d	5 5 3
J. Lucas	7½	9½	39/6	+1/6	4 12 9
Marryat & S. (2/-)	22½	22½	5/9	—	7 16 6
Mather & Platt ..	12½	15	49/-	+6d	6 2 6
Metal Industries ..	15	12*	40/-xd	—	6 0 0
Mid. Elec. Mfg. ..	15	15	59/6	—	5 0 10
Murex	15	15	56/-	−2/-	5 7 2
Newman Ind. (2/-)	10	10	2/3	—	8 17 9
Oldham & Son (1/-)	35	17½*	2/6	—	7 0 0
Parnall (Yate) (5/-)	6	6	2/10½	—	10 8 6
Parsons, C. A. ..	10*	12½	65/-	—	3 17 0
Plessey (5/-) ..	22½	25	25/6	+6d	4 18 0
Pye Deferred (5/-)	18	18	17/9	—	5 1 6
Revo (10/-) ..	27½	27½	46/6	—	5 18 3
Reyrolle	10*	12½	55/-	—	4 11 0
Scot. Cable (4/-) ..	32	20*	12/3xd	—	6 10 7
Siemens Ord. ..	10	10	32/6	—	6 3 0
Southern Areas ..	5	6	13/3	—	9 1 3
Strand Elec.(5/-)..	17½	17½	10/-	—	8 15 0
Sturtevant (5/-) ..	17½†	18·1*†	24/6	+6d	3 13 6†
Switchgear & Cowans (5/-)	22½	22½	14/-	—	8 0 9
Taylor, T. (5/-) ..	20	25	20/-	—	6 5 0
T.C.C. (10/-) ..	20	20*	35/-	—	—
T.C. & M... ..	10	8½*	27/6xd	—	6 3 8
Telephone Mfg.(5/-)	10	10	7/6	—	6 13 4
Thorn. Elec. (5/-)..	10	12½	10/6	—	5 19 0
Tube Investments	25	15*	56/6	—	5 6 3
Vactric (5/-) ..	Nil	Nil	5/9	+9d	Nil
Veritys (5/-) ..	7½	10	4/9	—	10 10 6
Walsall Conduits (4/-)	70	70*	44/6	—	6 5 10
Ward & Goldstone (5/-)	45	45*	36/3	+¼	6 4 4
Watford (2/-) ..	25	25	6/3	—	7 8 2
Westinghouse Brake	14	15	54/6	—	5 10 1
West, Allen (5/-) ..	15	15	11/3	—	6 13 4
Trusts, Transport and Communications					
Anglo-Am. Tel.: A Ord.	—	6	83½	+1	7 3 9
Ord.	—	3¾	57½	—	6 10 5
Anglo-Portuguese	8	8	21/6	—	7 8 10
Brit. Elec. Traction: Def. Ord. ..	25	35	580	+10	6 0 8
Cable & Wireless: Ord.	8	8	135	—	5 18 6
4% Loan ..	4	4	96	—	4 3 4
Calcutta Trams ..	6†	6†	21/6	−1/-	5 11 6†
Cape Elec. Trams	5	5½	12/-	—	9 3 4
Marconi Marine ..	10	10	28/-	—	7 2 10
Oriental Tel. Ord.	16	16	67/6	—	—
Telephone Props.	8	8	5½	+10/-	—
Tele. Rentals (5/-)	10	10*	9/-	−3d	5 11 0

* After capital bonus. † Dividends are paid free of income tax.

The above quotations are based upon the middle prices given in the Stock Exchange Daily Official List.

REPORTS and DIVIDENDS

The Hackbridge & Hewittic Electric Co., Ltd.—In his statement circulated with the report and accounts for the year ended 31st March last, Mr. T. F. Lister (chairman) says that they have experienced a decline in the demands made on their transformer and switchgear divisions, which has enabled them to give better delivery dates in respect of new business both at home and abroad. The demand for their glass bulb rectifiers shows no falling off and the order book for these is the largest in the company's history. With regard to the Canadian subsidiary, orders, including contracts for the United States, amount to $1,400,000. Now that they are able to promise better delivery dates with regard to transformers, they expect to derive their share of this business in Canada, which will be available during the immediate future because of the large expansion programmes already in hand for the development of hydro-electric power in that country. It is hoped that the recent easement of financial and other restrictions imposed on exports to Australia will continue so that by the end of the year normal trading conditions with Australia can be resumed.

Scottish Cables, Ltd.—The main figures in the accounts for the year ended 30th April last were given in our issue of 10th July. In his circulated statement, Mr. W. Fraser (chairman) says that new records were set up in the volume of business transacted both at home and overseas. Their associated company, Scottish Cables (South Africa), Ltd., completed its second year on 30th June, 1952, and the results achieved were such as to enable that company to increase its dividend. They started off the current year with good order books and the volume of output to date has more or less remained constant. Intake of orders has fallen considerably, due primarily to purchasers withholding the placing of business pending copper going off control early next month, but with the orders still in hand, together with the present intake of orders, they hope to bridge the gap caused by the temporary falling off in orders pending the return to more normal trading conditions following the decontrol of copper. Competition overseas has been more severe and self-industrialization of foreign countries is curtailing the export of goods from this country. To counteract this difficulty they established the South African company, and may find it necessary to extend still further their manufacturing interests abroad. No further steps have yet been taken in this direction, but the subject is under continuous review.

Ruston & Hornsby, Ltd.—The preliminary statement of the accounts for the year ended 31st March last shows that after meeting all charges, including £1,395,380 for taxation, the combined net profit is £1,126,522, as compared with £898,301 for the preceding year. Of this £303,047 is retained by subsidiaries, leaving the net balance of the parent company £823,475 (against £736,697). After deducting £484,918 placed to general reserve and £40,000 allocated to employees' Coronation bonus, it is proposed to pay an ordinary dividend for the year of 11 per cent (same), plus a Coronation bonus of 1½ per cent. The balance carried forward is £251,238 (against £247,187 brought in).

George Cohen Sons & Co., Ltd., report group profits for the year ended 31st March last of £1,764,760, as compared with £1,825,770 for the previous year. Taxation absorbs £1,296,156, leaving a net balance of £468,604 (against £714,270), of which £451,728 is attributable to the holding company. After making various allocations, it is proposed to pay a final ordinary dividend of 8½ per cent, making 12 per cent for the year on £1,500,000 ordinary stock. For the previous year the interim dividend was 8 per cent, followed by a final of 18 per cent, making 26 per cent on £600,000 ordinary stock.

Richardsons, Westgarth & Co., Ltd., in a preliminary statement, show a net profit for the year ended 31st March last of £346,289, as compared with £247,361 for 1951-52. Taxation absorbed £465,550. The proposed dividend for the year is 15 per cent (against 12 per cent).

Parmiter, Hope & Sugden, Ltd., report that after charging £48,722 for taxation, the net profit for the year ended 31st March last is £37,642, as compared with £38,228 for the preceding year. General reserve receives £15,710, and it is proposed to pay a final dividend of 18 per cent (against 17½ per cent), making 25½ per cent for the year (25 per cent). The balance carried forward is £25,135 (against £23,793 brought in).

Murex, Ltd.—The accounts for the year ended 30th April last, subject to audit, show a group profit, after providing £311,000 for taxation, of £393,000, as compared with £659,000 for 1951-52. It is proposed to pay a final ordinary dividend of 9 per cent, maintaining the distribution for the year at 15 per cent. The final dividend, however, is paid on capital increased by a "rights" issue of 200,000 new £1 ordinary shares.

British Relay Wireless & Television, Ltd.—Details of this company were published on Monday last. The concern is the holding company formed earlier this year to integrate the businesses of the British Relay Wireless

group and the Link Sound and Vision group. It has a nominal capital of £875,000 in £400,000 of 6½ per cent unsecured loan stock, £300,000 of "A" ordinary 5s shares and £175,000 "B" ordinary 5s shares. The "B" shares are held by Pye, Ltd., or Murphy Radio, Ltd., and do not rank for dividend until the "A" shares have received at least 16 per cent per annum for three consecutive financial periods; immediately 20 per cent per annum is declared on the "A" and "B" shares, the two classes will be amalgamated.

The English Electric Co., Ltd.—Application lists for the 4½ per cent debenture stock were closed soon after the opening on Thursday, last week, owing to heavy oversubscription.

The Greengate & Irwell Rubber Co., Ltd., has declared an interim ordinary dividend of 10 per cent (against 5 per cent).

New Companies

Brown Fintube Co. (Great Britain), Ltd.—Registered 3rd July. Capital £10,000. Manufacturing and dealing in heating, refrigerating, ventilating, lighting and control plant, etc. Solicitors: Wallace Robinson & Morgan, Birmingham.

W. H. Mottershead, Ltd.—Registered 7th July. Capital £500. Mechanical and electrical engineers, electricians, contractors, instrument makers, etc. Directors: W. H. Mottershead and Stella D. Davenport. Secretary: Stella D. Davenport. Regd. office: 113a, Graham Road, Wimbledon, S.W.19.

Liquidation

County Electronics, Ltd., radio, television and electrical engineers.—Winding up voluntarily. Liquidator, Mr. A. T. Eaves, 47, Mosley Street, Manchester, 2, appointed 10th July. Particulars of claims to the liquidator by 1st September.

Bankruptcies

R. J. Camden, 32, New Bridge Street, Exeter, electrical engineer.—Receiving order made 10th July on debtor's own petition.

R. B. Goetze, lately carrying on business at the Old Market, Wisbech, as an electrical contractor.—First meeting held 22nd July. Public examination 10th September at the Court House, London Road, King's Lynn.

A. E. Dalmon and **S. J. Dalmon,** carrying on business as sanitary and electrical engineers under the style of P. Dalmon & Sons, at 60, Teville Road, Worthing.—First and final dividend of 7s 5d in the £, payable on and after 24th July at the offices of A. E. Orbell & Co., 7, Old Steine, Brighton, 1.

J. W. Luker and **H. A. R. Phillips,** lately carrying on business in partnership at East Street, Lewes, and at 206, High Street, Lewes, under the style of Gordon & Luker, electrical contractors.—Receiving order made 13th July on debtors' own petition.

J. D. Stuart, 22, Yarra Road, Cleethorpes, Lincs, journeyman electrician.—First meeting to-day (Friday) at the Official Receiver's office, 8, Flottergate, Great Grimsby. Public examination 3rd September at the Town Hall, Great Grimsby.

R. E. Browne, electrical contractor, carrying on business under the style of Browne Brothers, at 121, Market Street, Dalton-in-Furness.—Last day for receiving proofs for dividend 1st August. Trustee, Mr. D. Atkinson, 14, Lowther Street, Carlisle, Official Receiver.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 15th August:—

ALIWYRE. No. B716,511, Class 6. Wire of common metal (not being insulated wire or fuse wire) and articles included in Class 6 made therefrom.—D.K.B. Electric, Ltd., 109, Kingsway, London, W.C.2.

GUS (design). No. 717,059, Class 7. Wringing machines, washing machines, lawn mowers, garden rollers, sewing machines, mincing machines, printing machines, and electric motors (not for land vehicles). No. 717,061, Class 9. Electrical apparatus included in Class 9; wireless, television, photographic, cinematographic, weighing, measuring and teaching apparatus and instruments, etc.—Great Universal Stores, Ltd., Devonshire Street, Ardwick, Manchester, 12.

ELECTRIX. No. 690,730, Class 9. Electric domestic vacuum cleaners and parts included in Class 9.—Electrix, Ltd., Sterling Works, Dagenham, Essex.

MONITROL. No. 710,092, Class 9. Thermostats, thermostatic valves, thermo-electric control valves, electrically operated ignition systems, and parts included in Class 9 of all these goods, all for use with fluid fuel burners, water heaters, space heaters and cooking apparatus.—Monitor Engineering & Oil Appliances, Ltd., Monitor Works, Flaxley Road, Stechford, Birmingham, 9.

FOSTRONIC. No. 716,674, Class 9. Instruments and apparatus for controlling and measuring temperature.—Foster Instrument Co., Ltd., Letchworth, Herts.

WELOHM. No. 716,932, Class 9. Electrical apparatus and instruments and parts included in Class 9 for all these goods.—Welwyn Electrical Laboratories, Ltd., Trading Estate, Bedlington Station, Northumberland.

MICOX (design). No. 717,475, Class 9. Electrical apparatus included in Class 9 for domestic and household purposes and parts included in Class 9 for all these goods.—Etablissements Gendron Freres, Lyons, France. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

TRUSTACORD. No. 717,658. SONOCORD. No. 717,659, Class 9. Electronic apparatus and instruments included in Class 9; and apparatus and instruments for recording and reproducing sound, radio sets (sold complete); and parts included in Class 9.—Trust Accessories, Ltd., Excelsior Works, Hulme Hall Road, Manchester, 15.

CONYCOTE. No. 717,886. CONYMEL. No. 717,887. CONAMBOND. No. 717,934. CONYBOND. No. 717,935. CONYLITZ. No. 717,936. All Class 17. Electric insulation materials; and electric insulators and parts included in Class 17.—Connollys (Blackley), Ltd., Blackley Vale Mills, Blackley, Manchester, 9.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 2nd September from the Patent Office, 25, Southampton Buildings, London, W.C.2

1948

13432. Automatic Electric Laboratories, Inc.—Automatic telephone system. 18th May, 1948. (696571.)

13786. Standard Telephones & Cables, Ltd., and Mullarkey, A. J.—Railway axle counting equipment. 21st May, 1948. (696542.)

15812. Standard Telephones & Cables, Ltd., and Mullarkey, A. J.—Gas discharge tube counting arrangements. 11th June, 1948. (696543.)

15814. Standard Telephones & Cables, Ltd., Brown, A., and Mullarkey, A. J.—Railway axle counting equipment. 11th June, 1948. (696544.)

1949

32515. Fairey Aviation Co., Ltd., and Maisey, A. J.—Visible indicator selector switches. 19th December, 1950. (696476.)

1950

13521. Trico-Folberth, Ltd.—Thermally-actuated electric circuit interrupting devices. 19th June, 1951. (696642.)

14498. Ashley Accessories, Ltd.—Snap-action quick-make-and-break electric switches. 23rd May, 1951. (696421.)

15010. Siemens & Halske Akt.-Ges.—Electric condensers. 15th June, 1950. (696423.)

17571. General Electric Co., Ltd., Cottis, F., and Jacobs, H.—Enclosed electric switches. 19th September, 1951. (696645.)

21493/4. Marconi's Wireless Telegraph Co., Ltd.—Protecting system for electronic valves. 31st August, 1950. (696430/1.)

22360. Communications Patents, Ltd.—Wired broadcasting systems. 11th December, 1951. (696584.)

23883. Western Electric Co., Inc.—Telegraph switching systems. 29th September, 1950. (696552.)

24666. Electric & Musical Industries, Ltd.—Automatic control devices for gramophones and the like. 27th September, 1951. (696494.)

25010. Midland Electric Manufacturing Co., Ltd.—Combined electric switches and fuse holders. 3rd September, 1951. (696495.)

25419. Babcock & Wilcox, Ltd.—Inspection means for viewing the interiors of combustion chambers. 17th October, 1951. (696434.)

27927. Teletype Corporation.—Printing telegraph circuits. 5th April, 1948. (696554.)

28026. Automatic Telephone & Electric Co., Ltd.—Dial switches for use with coin-box telephone instruments. 14th November. 1951. (696588.)

28118. English Electric Co., Ltd.—Gas-turbine plant. 19th November, 1951. (696555.)

28497. Electric & Musical Industries, Ltd.—Magnetic sound transducing apparatus. 22nd November, 1951. (696650.)

28898. Dobbie McInnes, Ltd.—Method of and means for compensating electrical measuring instruments for errors due to variation in the frequency of the supply. 21st November, 1951. (696436.)

29755. British Thomson-Houston Co., Ltd.—Variable electric resistance devices. 5th December, 1950. (696499.)

1951

948. Telefonaktiebolaget L. M. Ericsson.—Voice frequency signalling system. 12th January, 1951. (696503.)

1738. General Electric Co., Ltd., and Harling, D. W.—Electric signal coupling circuits. 15th January, 1952. (696441.)

2012. Cole, Ltd., E. K., and Savory, W. G.—Electric lighting fittings. 28th January, 1952. (696596.)

5175. Boulton Paul Aircraft, Ltd.—Method of and apparatus for indicating amplitude modulation of an alternating carrier voltage. 3rd March, 1952. (696447.)

5544. Metropolitan-Vickers Electrical Co., Ltd.—Alternating current electric measuring circuit arrangements 21st January, 1952. (696511.)

5649. Wiggins Teape & Co. (1919), Ltd., and Gladstone, R.—Method of comparing inductances or capacitances and apparatus therefor. 2nd May, 1952. (696512.)

7858. Marconi's Wireless Telegraph Co., Ltd.—Microwave aerial arrays. 20th November, 1951. (696659.)

13206. Oldham & Son, Ltd., and Chamberlain, J.—Contacts for photo-electric cells. 12th June, 1952. (696523.)

13230. International Resistance Co.—Variable resistors. 4th June, 1951. (696453.)

13534. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Refrigerators. 7th June, 1951. (696525.)

15550. Rudman Darlington & Co., Ltd., and Darlington, T.—Electromagnetic recording apparatus. 12th June, 1952. (696610.)

17760. British Thomson-Houston Co., Ltd.—Electric convertors. 30th April, 1952. (696530.)

19320. Tyler Co., W. S.—Electrically heated screening apparatus. 16th August, 1951. (696613.)

20867. Gretener, E.—Apparatus for reproduction of television pictures. 4th September, 1951. (696615.)

23603. Soc. l'Air Liquide, Soc. Anon. pour l'Étude et l'Exploitation des Procédés G. Claude.—Electric arc generating and stabilizing circuit. 10th October, 1951. (696619.)

26278. Philips Electrical Industries, Ltd.—Circuits for stabilizing the speed of d.c. motors. 9th November, 1951. (696462.)

27056. English Electric Co., Ltd.—Dynamic compressors. 19th November, 1951. (696566.)

30143. Tickner, A. (Lewis Engineering Co.).—Electrical apparatus. 24th December, 1951. (696532.)

1952

892. Teletype Corporation.—Selecting devices responsive to code signals. 5th April, 1948. (696567.)

1255. Brush Development Co.—Twister-type electromechanical device. 16th January, 1952. (696464.)

1556. Bullen, F. J., and Small, C. J. P.—Electromagnetic transducing devices. 18th January, 1952. (696629.)

3987. Schlumberger Overseas Soc. Anon.—Electrical logging of earth formations traversed by a bore hole. 14th February, 1952. (696535.)

5995. Philips Electrical Industries, Ltd.—Circuit arrangements for igniting photographic flash-bulbs. 7th March, 1952. (696468.)

6699. Mallory Metallurgical Products, Ltd.—Resistance welding electrodes. 14th March, 1952. (696570.)

13693. Picker X-Ray Corporation Waite Manufacturing Division, Inc.—Demountable X-ray apparatus. 29th May, 1952. (696538.)

Amended Specification

678370. M-O Valve Co., Ltd., and another.—Magnetron oscillators.

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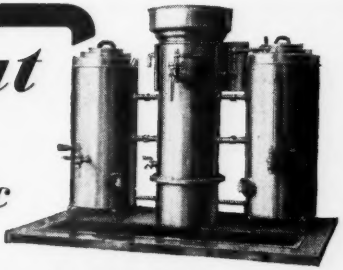
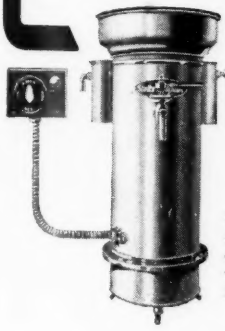
also at 25 Elmbank Street, Glasgow, C.2

Higher output – lower cost – fully automatic



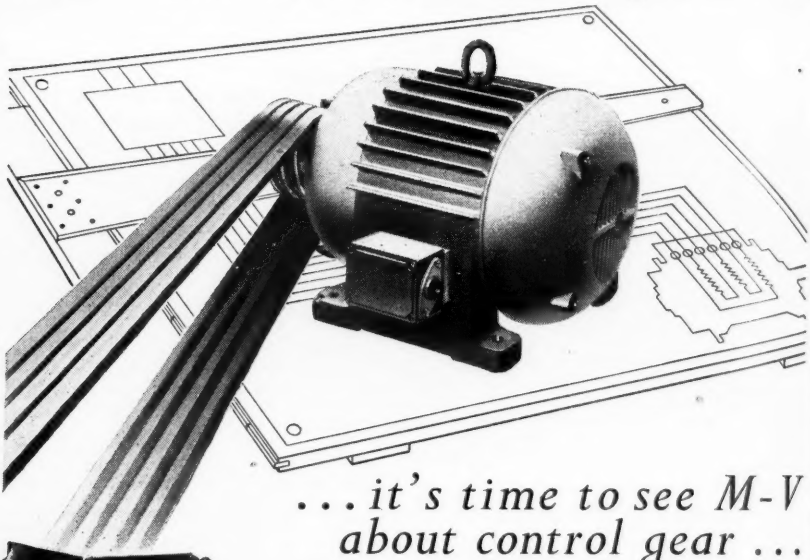


Stott's new Electric Water Boilers and Cafe Sets give higher outputs and lower running costs at reduced prices. Revolutionary improvements in design include fully automatic operation and a thermostatically controlled pre-heated reserve which ensures large and instantaneous supplies of fresh boiling water. An automatic cut-out prevents over boiling and steaming to waste. Three sizes are available giving outputs of 35, 55 and 75 pints in 10 minutes with loadings of 6.5, 9.75 and 15 kW respectively.

★In copper or chrome: for full details and prices, write for Brochure No. EA27

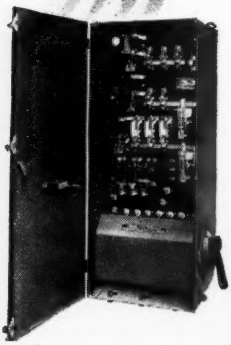
"Quality Built"
"Stotts of Oldham"

When a Motor Drive is on the drawing board ...

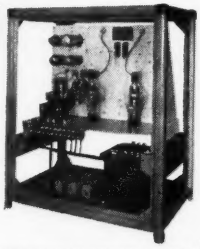


... it's time to see M-V about control gear ...

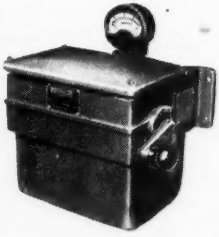
When you are thinking of installing a motor, think also of Metrovick control gear. Trouble, time and cost are saved by consulting M-V when a motor drive is in the planning stage. M-V design and build all types of control gear from switch-starters for fractional hp motors to elaborate electronic controls for complex industrial processes. The experience of M-V engineers therefore covers the complete range of control gear and their practical advice is at your service.



M-V Stator-rotor Contactor Starter



M-V Electronic Speed-control Equipment



M-V Hand-operated Oil-break Starter

METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED, TRAFFORD PARK, MANCHESTER 17

Member of the A.E.I. group of companies

METROVICK *Control Gear for all Motor Drives*

H/A005

Radio Research

Progress During 1952

THE reports of the Radio Research Board and the Director of Radio Research are included in "Radio Research 1952" which has just been published by H.M. Stationery Office for the Department of Scientific and Industrial Research, price 2s (50 cents U.S.A.). The Board again expresses its concern at the shortage of staff needed to carry out the full research programme and points out that some deterioration has taken place during the year. The major part of the programme of research is concerned with wave propagation. Most of the work is fundamental long-term investigation of importance in the efficient operation of radio-communication systems.

Ionospheric Research

Research into the behaviour of the ionosphere makes possible the efficient planning of the operation of high-frequency communication systems. Two new ionospheric observations were brought into use during the year, one at Khartoum and the other at Port Lockroy, in the Falkland Island Dependencies. There are now seven observatories established under the auspices of the Department in this country and overseas for the study of the properties of the ionosphere. Other countries maintain another sixty observatories. The effects of the ionosphere on vertically-directed transmissions are observed and, from these, forecasts are prepared of its behaviour for the more nearly horizontal directions common in practical commercial transmission. From these data forecasts can be made of the best frequency bands to be used for particular purposes.

A direct method of examining the behaviour of the ionosphere at oblique-incidence is being developed. Signals propagated by way of the ionosphere and reflected back to the transmitting point from regions on the earth's surface up to several thousand km distant are picked up and measured. The skip distances observed in this way have been found to agree with calculated values obtained from vertical-incidence observatories immediately below the reflecting point in the ionosphere. It is thought that the new technique can be used to study propagation conditions *at a distance* and so supplement the information obtained from the sparsely distributed observatories which keep watch on the behaviour of the ionosphere immediately above them.

The total eclipses of the sun which took place in February and August, 1952, offered opportunities for observation of the effects of the eclipses on radio communications. Two expeditions visited Africa for the February eclipse. One party made observations at Khartoum, where the eclipse was total, and the other at Ibadan (Nigeria), where the eclipse was 75 per cent. The August eclipse, which was total in South America, was observed from the existing observatories of the Department at Port Stanley, Falkland Islands, and Port Lockroy.

Investigations are being made into the effects on radio waves of varying refraction caused by the atmosphere and the effects of irregular ground on transmission. The studies are carried out by recording the field strength produced at distances up to about 150 miles from the British television transmitters. The results are of use in planning v.h.f. broadcasting and communication services. Observations have also been made on transmissions at 600 Mc/s from a temporary aerial mounted on the television mast at Sutton Coldfield.

Ground Wave Propagation

The speed of propagation of the ground wave at low frequencies—or more specifically, the phase of the signal and its rate of change with distance—are important factors in the operation of some navigational aids. The speed is dependent on ground conductivity and so on geological structure. Phase changes along paths covering different geological structures have been measured, transmissions from stations of the Decca

Navigator System being used. In the ground structure between the Lewes and Norwich stations, marked geological changes take place, particularly that between the chalk of the North Downs and the Thames marshes near Gravesend. The results of the investigations in general confirm theoretical expectations and, using the experience gained, a new method of measurement is being developed to examine the case of transmission across a coast-line.

Radio noise, whether originating within or outside the receiver, is a major factor affecting the efficiency of radio equipment. The Radio Research Station has continued its research into the world-wide distribution of atmospheric noise, which is caused by lightning flashes. Observations of the strength of this noise are carried out regularly at a number of stations throughout the world, and information is being collected which eventually will enable more accurate predictions of atmospheric noise-levels to be made.

Work on noise originating in the receiver itself has included the study of the noise spectrum of point-contact germanium rectifiers over the frequency range 0·1 c/s to 10 Mc/s. It has been found that there are at least three separate components which determine the shape of the spectrum. The results of the noise studies, together with an experimental investigation of other characteristics of germanium diodes, are being examined in relation to existing theories. Research is also in progress at Imperial College, London, on the relation between the structure of certain inorganic compounds and their ferromagnetic and ferroelectric properties.

E.D.A. PUBLICATIONS

ELECTRIC lighting makes old buildings usable; *planned* lighting can make them efficient as well, is the conclusion reached in "Farm Lighting," the third in the series of farm electrification handbooks published by the British Electrical Development Association, 2, Savoy Hill, London, W.C.2 (price 2s 6d post free). Consisting of 80 pages and well illustrated by photographs and diagrams, the book has been written not only to help the farmer, but also the farmers' electrical adviser, agricultural college students, Electricity Board staffs and electrical contractors.

The book contains an appendix giving in diagrammatic form details of a number of typical farm lighting layouts. In a chapter on lamps the construction and characteristics of both filament and discharge types are described in detail, tabulated data giving the comparative costs of purchasing and running filament and fluorescent lamps.

A comprehensive handbook for the amateur, "Electricity in Your Garden," has been published by the Association. The handbook, which is fully illustrated, consists of 32 pages, and it is divided into three main sections: soil warming, greenhouse heating, and other uses of electricity. The first section contains detailed information on the choice of soil warming equipment, with notes on its installation and use in conjunction with frames and hotbeds for the raising of early salad crops. In the section on greenhouse heating the various systems of electric heating are described. The section devoted to other applications of electricity contains brief notes on its use for the artificial illumination of seedlings, soil sterilization, pasteurizing, driving lawn mowers and for operating pumps.

"Electricity in Your Kitchen," a 16-page booklet now available free from E.D.A., analyses in a concise, practical way the positive advantages of electric cooking, water heating, laundry work, refrigeration, lighting, etc. The booklet is attractively produced in four colours and is profusely illustrated.

Coal Preparation Plant for Australia

THE General Electric Co., Ltd., announces that its Fraser & Chalmers Engineering Works has received through the company's associates in Australia, the British General Electric Co. (Pty), Ltd., a contract to provide a coal preparation plant for the Corrimal Colliery of the Corrimal Coal & Coke Pty., Ltd., of Sydney, N.S.W. This coal preparation plant is to have a capacity of 200 tons per hour of coking coal, and the equipment includes one 10ft diameter Chance cone with ancillary screening and loading equipment which will comprise Sherwen electromagnetic screens, and Fraser & Chalmers shaker type screens. In addition to the above, a water clarification plant is to be supplied, and the whole will be installed at Corrimal Colliery near Port Kembla, N.S.W.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Birmingham.—17th August. Rating and Valuation Committee. Replacement of passenger lift at the Rates Department offices, Edmund Street. City engineer, Civic Centre.

Chard.—20th August.—Corporation. Street Lighting equipment. (See this issue.)

Cheltenham.—24th August. Town Council. Trunk road lighting. (See this issue.)

Darlington.—20th August. Corporation. Electrically driven sludge pump, 500 g.p.m. capacity, for sewage disposal works. Borough engineer, Town Hall.

East Kesteven. — 8th August. R.D.C. Pumps with electric motors and switchgear. Silcock & Simpson, consulting engineers, 10, Park Row, Leeds, 1.

Formosa.—TAIPEI.—10th August. Central Trust of China. Cable and wire, conduit fittings, lamps and other electrical apparatus. (C.R.E. 23018/53. Ten/6761.)*

Guildford.—12th August. Street lighting equipment and supply and laying of cable. (See this issue.)

Mildenhall.—10th August. R.D.C. Duplicate booster pumps with motors and switchgear. Silcock & Simpson, consulting engineers, 10, Park Row, Leeds, 1.

Montrose.—7th August. Town Council. Street lighting equipment. (See this issue.)

New Zealand.—WELLINGTON.—6th August. Post and Telegraph Department. Supply of 1,500 50 V, 40 W b.c. pearl "rough service" lamps. (C.R.E. 24257/53. Ten/6776.)*

Salford.—31st August. City Council. Electrical installation at Blackfriars Public Baths. (See this issue.)

Stretford.—15th August. Steel poles for street lighting. (See this issue.)

Tangier.—12th September. Tangier Water and Electricity Board. Electrical equipment for three transformer stations. (C.R.E. 23140/53. Ten/6762.)*

Uruguay. — MONTEVIDEO. — 18th August. Usinas Electricas y los Telefonos del Estado. Supply of 220 V armoured cables and cable boxes. (C.R.E. 23764/53. Ten/6767.)* 20th August. Supply of 146 automatic circuit breakers. (C.R.E. 23749/53. Ten/6771.)* 28th August. Electrical materials and equipment for substations. (C.R.E. 23741/53. Ten/6766.)*

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

ORDERS PLACED

Burnley.—Education Committee. Recommended. Electrical installation work at Rosegrove County Junior School (£1,661).—Greenhalgh & Duxbury, Ltd.

Darlington.—Town Council. Electrical work in 84 houses on the Firth Moor estate (£1,960).—W. L. Clark.

Gateshead.—Education Committee. Electrical installation at the new Dryden Road Grammar School (£8,494).—T. Mitchelson (Electrical), Ltd.

London.—HOLBORN.—Borough Council. Recommended. Lift installation at Endsleigh Street housing site (£2,361).—Express Lift Co., Ltd.

ST. MARYLEBONE.—Borough Council Works Committee. Recommended. Renewal of switchgear and central distributing cable at Lisson Grove depot (£3,036).—Locke & Soares (1942), Ltd.

Stoke-on-Trent. — Corporation. Recommended. Electrical installation work at "Moorhill," Leek, Old People's Home (£709).—F. W. Harris & Co., Ltd. Electrical installations in 44 houses in Group 9 (£1,745) and 32 houses in Group 11A (£1,114) on the Blurton No. 2 estate and in 22 houses in Group 5 (£751) and 22 houses in Group 6 (£860) on the Newstead Farm estate.—F. Hancock (1939), Ltd.

Thornaby-on-Tees.—Town Council. Electrical work in 72 houses (£1,348).—W. S. Wilkes. Electrical wiring of 299 houses and four shops and flats (£3,936).—F. Dixon Barker, Ltd. Similar work at 43 houses (£531).—A. R. Hunt.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abergavenny.—Infants' school at Llwynu; county architect, Queen's Hill, Newport, Mon.

Akley Heads (Durham).—Extensions and alterations to motor control building (£15,000); Purdie, Lumsden & Co., Ltd., 25, Oxford Street, Newcastle.

Aldershot.—Flats (132), Denmark Square; city surveyor.

Bedford.—Houses (159), Church Lane; C. H. Blakeway, borough surveyor, Newnham House, Horne Lane.

Bolton. — R.C. church; Greenhalgh & Williams, architects, Mawdsley Street.

Brownhills.—Factory, Lichfield Road, for Perfichrome, Ltd.; H. Holland, architect, 38, Edward Street, West Bromwich.

Brecon.—Assembly hall and gymnasium, Christ College; T. Roderick & Sons, architects, 24, Clifton Street, Aberdare.

Cardiff.—R.C. secondary school; F. G. Bruton & Mace, 11, Cathedral Road, architects.

Carlisle.—R.C. church at Harraby; W. C. Mangan, architect, 2, Ribblesdale Place, Preston.

Chelmsford. — Block of offices; British Vitamin Products, Ltd.

Chester-le-Street.—Houses at Pelton (86) and Sacriston (37); F. Bowman, R.D.C. architect, Estate Office, Birtley, Co. Durham.

Colne Valley.—Houses (30) at Corn Mill site, Slaithwaite, for U.D.C.; Holroyd, Brook & Eagland, Ltd., Slaithwaite.

Coventry. — Large hostel at the Butts; Y.W.C.A. authorities.

New police headquarters costing £300,000 (starting date March, 1954); city architect.

Omnibus garage, Sandy Lane; Gilbert Ash, Ltd., London.

Crewkerne. — Dwellings (12), Severalls; Pelter, Warren & Roydon Cooper, architects, The Old Oxford Inn, West Hendford, Yeovil.

Durham.—Additions to Houghall School of Agriculture for the C.C.; county architect, Court Lane.

Eleven hostels for old people to be built by County Council; G. R. Clayton, Court Lane, Durham.

Exeter.—X-ray department at City Hospital; South Western Regional Hospital Board, 27, Tyndalls Park Road, Bristol.

Bank and offices, City Centre; Westminster Bank, Ltd., 41, Lothbury, E.C.2.

Gloucester.—Extensions, Coney Hill Hospital; T. F. Lawson, architect, 2, Clarence Street.

Harwich.—Houses (30), on sites at Dovercourt and Harwich; borough architect, Town Hall.

Hemel Hempstead.—Houses (58), Warners End site; borough engineer.

Hendon.—Works extensions; Spurling Motor Bodies, Ltd., The Hyde, N.W.9.

Hull. — Central police station in Queen's Gardens; city architect, Lowgate.

Ilford.—R.C. church, Cranbrook Road; D. R. Burles, architect, 59, Exford Avenue, Westcliff-on-Sea.

Works extensions; Ray Powell, Ltd., 393, Eastern Avenue.

Flats (84), Marks Gate estate; Hammond & Miles, Ltd., builders, Scrafton Road Works.

Immingham.—Further 100 houses for Grimsby R.D.C.; Council's architect, Grimsby.

Lampeter. — Adaptations at Falcondale Mansions to provide old people's home; county architect, County Hall, Aberayron.

Lancaster.—Laundry at the Royal Albert Hospital (£22,450); architect to the Manchester Regional Hospital Board, Cheetwood Road, Manchester, 8.

Lanchester.—Houses (40) for the R.D.C.; Wright & Kellett, Ltd., builders, Ashley Terrace, Chester-le-Street.

London.—BRIXTON.—Flats (57), Acre Lane; Rowley Bros., Ltd., builders, Tower Works, Dunloe Avenue, N.17.

CHELSEA.—Extension, Chester Beatty Research Institute Laboratory; Royal Cancer Hospital Committee, Fulham Road, S.W.3.

HAMPSTEAD.—Maisonnettes (96) and flats (12), Broadhurst Gardens; Richard Nickson, architect, 33, Welbeck Street, W.1.

HAYMARKET.—Office and showroom block; E. A. Stone, Toms & Partners, architects, 26, South Audley Street, W.1.

LEWISHAM.—Departmental store, Belmont Hill; Royal Arsenal Co-operative Society, Ltd., Powis Street, S.E.18.

SOUTHWARK.—Warehouse, Griffin Street; Holliday & Greenwood, Ltd., 11, Buckingham Palace Gardens, S.W.1.

Manchester.—Extensions at Prestwich Hospital (£45,000); T. Duffy, architect to Regional Hospital Board, Cheetwood Road, Manchester, 8.

Mansfield.—Works extensions; Foister, Clay & Ward, Ltd., Belvedere Street.

Middlesbrough. — Houses (440), west of Marton Road for the T.C.; J. A. Kenyon, borough engineer.

Middleton. — Shops (39), Langley estate (£107,375); L. C. Howitt, city architect, Manchester.

Mobberley. — Modernization of approved school for boys (£34,573 est.) for T.C.; L. C. Howitt, city architect, Town Hall, Manchester.

Moulton (Northants). — Modern school (£100,000); county architect, County Offices, Guildhall Road, Northampton.

Newcastle-on-Tyne. — Three primary schools on the Montagu estate, Kenton Lane estate and at Fawdon; city architect.

Plymouth.—Large business premises at New George Street corner site; Horne Bros., Ltd., Oxford Street, London, W.1.

Flats (48), Notte Street; city architect.

Sheffield.—Practical and science wing at King Edward VII Grammar School; city architect.

South Shields.—Special school (150 children); R. Collins, architect, Russell Buildings, King Street.

Spalding.—Primary school, Queens Road; county architect, Boston, Lincs.

Stockton-on-Tees.—Municipal buildings on the cattle market site; borough architect, 28, The Square.

Stowmarket.—Grammar school (£138,666) for East Suffolk E.C.; E. J. Symcox, county architect, County Hall, Ipswich.

Sunbury-on-Thames.—Houses (80), Beechwood Avenue; Eden Residential Construction, Ltd., 1, Church Terrace, Richmond, Surrey.

Tipton.—Works extensions; British Castors, Ltd., Whitehall Road, Great Bridge.

Walsall.—Showrooms, stores and distribution centre; J. & H. Nicholls, Ltd., Glebe Street.

Watford.—Garage, workshops and offices, Holywell estate; McKay Transport, 36, Queen Mary's Avenue.

Willesden.—Flats and maisonnettes (104), Alpha Place area; borough surveyor.